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THE ELECTRICAL CONTRACTORS' CONVENTION.

The addresses by Messrs. Jas. R. Strong and F. P. Bissell at the convention of the National Electrical Contractors last week, at Toledo, as well as considerable other talk off the floor of the convention, bring to the surface some of the trade friction of the past few years among manufacturers, jobbers, and local contractors or supply dealers as to the prices given to these various classes. It is erroneous to assume that the electrical trade has had a monopoly on internal friction of this kind, for it has existed more or less in other trades for years, and perhaps always. The fundamental trouble in the electrical business seems to have been due to two causes: First, the willingness of certain jobbers or dealers to do a picayune retail business at wholesale prices; and second, as a result of this, an attempt to establish artificial lines of price demarcation between the manufacturers, jobbers and contractors or dealers. If sound principles of trade had been adhered to in the first place by all concerned, and if prices had been wholly based on quantity purchased rather than on some artificial distinction between classes, the trouble never would have existed. These things are bound in the long run to settle down to the fundamental economic principle in merchandising, that the quantity handled and sold at one time largely governs the cost of selling. It is unreasonable to assume that any association or set of associations can get together and resolve this principle out of existence. There is no reason why one man calling himself a jobber and purchasing 100 articles of a certain kind in a year should receive a lower price from the manufacturer than another man calling himself a contractor and dealer who purchases 10,000 articles of the same kind in a year. Competition among manufacturers will regulate matters otherwise, and it is right that it should.

The original trouble started from the disregard of this principle by manufacturers and large jobbers who sold to small dealers and contractors at the same price that they would sell to considerably larger concerns with larger gross yearly purchases. It would seem to be quite evident to any manufacturer that the cost of selling in small quantities is greater than in large quantities, but the desire to get business, probably coupled with ignorance as to actual selling costs, have made the trouble. As a result of this, various contractors' and jobbers' associations have attempted to define by resolution what should constitute a contractor and what a jobber, and to establish different scales of prices for these two classes. The plan has never worked in practice and the result has been in some cases little short of child's play. The large contractors have in some cases started up jobbing houses under a different name for the sake of getting jobbers' prices, under the association rulings, and doubtless in many cases have done a business in excess of jobbing houses having no connection with the contracting business. On the other hand, if a concern of sufficient size to do a jobbing business happens also to be engaged in the con-

tracting business in the city where it is located, what moral objection can any contractor urge against this proceeding? True, as Mr. Bissell pointed out in his address before the contractors, too many irons in the fire is likely to result in disaster, but that certainly falls more heavily on the man who tries the experiment than on anyone else. As Mr. Strong so forcibly pointed out in his remarks, agreements alone cannot separate classes in the trade. The only line of division possible is the line between wholesale and retail. In the past contractors and jobbers have too often failed to recognize the principle that quantity governs price. If merchandising business is ever to come under the control of a public commission, as have railroads and other public utilities in some States, these commissions would make short work of any distinctions between trade classes, and sales would have to be made, as they are now, by commission-controlled public utility companies, namely, on the basis of relative cost of different classes of service as nearly as those costs can be estimated. Of course, it is not strictly true that in a merchandising business cost is absolutely proportional to quantity sold, but any difference in price must be based on actual differences in cost of selling and handling goods, rather than upon some artificial distinction which soon breaks down under the pressure of competition. The failure of trade agreements in the past to hold on any other basis is ample proof of this.

Beauty and Dividends.

Two men were standing in front of a fine, new electric power station in an Eastern city. Both are engaged in electrical pursuits, and they were inspecting the exterior of the building with the eyes of men familiar with the business represented. The structure conveyed the idea of solidity and permanence, but, in addition, its designers had paid considerable attention to architectural effect. "That's certainly a handsome power house," said one. "Yes," returned the other, "but all that 'gingerbread work' doesn't pay dividends." The sentiment thus expressed is one widely held among practical electrical men; but it appears that the time is at hand when more attention must be paid to the mere appearance of electrical structures, aside from their stability, strength and safety. It is not quite true to say that the money spent in making an electric power house to some extent beautiful is wholly lost in that it pays no dividends. The effect of the building and its grounds on the public must be considered. A handsome building—not frivolous, of course, but one in which the bald, severe, commonplace lines of the old type of power house are replaced by more handsome materials and more stately design—induces a feeling of pride and pleasure among the citizens of the community, and undoubtedly tends in the direction of a sentiment of friendliness toward the builder. In these days of public-service commissions this sentiment, although intangible, is undoubtedly of great value and should be cultivated. The authors of the monumental "Plan of Chicago," recently mentioned in this journal, no doubt spoke the truth when they said that "A well-arranged grass plot, a few shrubs and a little regular attention will give to the plainest building a setting that, like a soft answer, will often turn away wrath from a public-service corporation." If in addition the building itself is dignified and attractive the effect is enhanced. In the earlier days of the art utility was of paramount importance, and, of course, that is the case in many localities at the present time. But as the country progresses in all directions from cruder things to those more in consonance with higher development, material and spiritual, the electrical industry cannot ignore the finer sense of the public. More attention to appearance is demanded, and, within certain sensible limits, ornamentation of electrical structures will be found to pay in eliciting public approval. This applies not only to power houses, substations and the like, but to posts, poles and other structures which support wires, lamps or transformers. The municipal art societies in the various cities give evidence of the effort to beautify these structures, among others common to city streets. The subject must be viewed in a broad light, with minds open to the signs of the times, for there is a sense, and a very real one, in which attractiveness on the part of public-service corporations does pay dividends.

Engineering Education.

In the matter of education required by the engineer, the opinion of Dr. Steinmetz should carry great weight, and we are glad to see that in a recent A. I. E. E. convention address he throws his influence squarely in favor of a broader type of education than has of late been usual for the engineering student. With his opinion that the study of the classics is important and valuable for engineering students, since their avocation in this era of specialists tends to narrowness, we heartily agree. The classics in themselves are not necessarily the only road to broad culture, but there is none which experience has proved to be more practicable. The highly organized ancient languages, with their wealth of literature and philosophy, have shown themselves particularly efficient in training the intelligence and quickening the perceptions. Undoubtedly, as Dr. Steinmetz states, the modern languages are for educational purposes less important since they but open another door to our own world; yet we would hardly follow him in the wish for their elimination from the engineering curriculum. The most important of them from the technical standpoint is Dr. Steinmetz's mother tongue, as it is quite certain that the engineering student needs it in his business. A vast amount of important matter is published in German and never translated at all, or so briefly abstracted as to be of small value for reference. When one considers that so important a treatise as Helmholtz's "Physiological Optics" does not exist in an English translation, the moral is obvious without argument. The engineer who desires to follow up the work of his contemporaries must know at least German, and he will find ample use for French and Italian if he undertakes certain lines of study. Even the modest acquaintance with modern languages gained in college is of material practical value, even if it does not open the door of a broader culture. Modern languages cannot properly be eliminated from the college unless by requiring one or more of them for admission. Engineering as a trade needs them more than it needs the classics. Engineering as a broad profession needs both.

We quite agree with Dr. Steinmetz that the influence of specialized engineering studies at the present time is narrowing, like every form of specialization, not because it is engineering, but because it may become microscopic in its point of view. And this may be the fate even of classical studies. The student who writes an exhaustive thesis on the use of enclitics in Isocrates is in no better case spiritually than he who devotes

his exclusive labors to the seat of the e.m.f. in thermo-electric couples. Both are traveling the path that leads to an intellectual crevasse. What is worse, both are likely to become bores. There is but one corrective to the modern tendency for over-specialization, and that is adequate time taken for education. The day has gone by in which a youth can, like The Admirable Crichton, hang up a defiance offering to debate with all comers concerning any branch of knowledge. The world of learning has widened, and he who hopes to be more than a mere mousing specialist in its byways must take time for intellectual growth. To one who is able, or rather determined, to take this time the study of the classics is the doorway to a new world. He needs them not because their intimate study whets his wits to a finer point than any other kinds to keen investigation, but because they are the story of the education of the race. It is a priceless thing for a young man to realize that 25 centuries ago there lived by the Ægean sea a people that knew nothing about electric lights or trolley cars or storage batteries, that would have exiled Graham Bell as a wizard and passed up a cup of hemlock to Marconi, and yet had a deeper and a finer civilization, and a keener intellectual interest and spiritual insight, than any that the world has since disclosed. It is no less a lesson to realize that five centuries later the genius of organization reached in imperial Rome a height beyond the powers of all who have come after, and that the strength and the weakness of the later nations, their laws, their ambitions and their frailties, were there epitomized. It broadens the view to learn that the conceptions and ideals of one's own time are not innate and perpetual, but are a transitory evolution from past sociologic development. It is this broader view, this truer sense of permanent values, that gives to the classics their unique importance in the world's education. It is a pity that in the hurry of the twentieth century more recognition is not given them. But the clash of interests is so fierce that everything has been pushed aside. We shall be calmer and wiser a few generations hence, perhaps, but in the time between let not the lessons of the ages be forgotten.

As to engineering education in general, no discussion of its scope or character can have any finality until the class of engineers to which the discussion actually applies is clearly distinguished. In recent years the term "engineer" has assumed an ambiguity which can be likened to that which 20 or more years ago led to the abandonment of the term "electrician"—previously in dignified repute—to those in the humbler branches of the electrical industry who chose voluntarily to assume it. Until of quite recent date, an engineer, properly speaking, was one whose work was associated with the creative side of human endeavor, whose specific function was to tame and subordinate to the uses of man the forces of nature. He was supposed to be of the class that enrich mankind by making two blades of grass grow where formerly only one had flourished. Under recent extensions of the term to embrace also those engaged in the financial exploitation of engineering, for "blades of grass" we should perhaps read "dollars," and for "mankind" read "employer" as the ultimate as well as immediate beneficiary. Owing to modern specialization of effort, the all-around engineer is becoming a *rara avis*, and of the newer genus one can already enumerate more than a score of species who correspond in a greater or less extent to the old conception of man in communion with the forces of nature in order to betray them to utilitarian use, and whose work, though immediately perhaps only of profit to himself or to his employer, ultimately enriches mankind as a whole. Next comes the class represented in part by the operating engineer, to which class the captured and tamed forces are confided for routine toil in utilitarian service, and whose members, in addition to service to an employer, serve also that part of mankind locally dependent on technical skill for the regular supply of a necessity or convenience. Finally, we have a recent addition, above referred to, whose field is that of commercial exploitation, whose functions have little relation either to engineering creation or engineering operation, and whose service inures entirely to the benefit of the employer. In passing it may be pointed out that salaried return for individual effort in the several classifications appears to be in inverse proportion to the number of those who receive ultimate benefit from such effort. To return to our text, is it possible to discuss profitably engineering education without reference to the specific and often antagonistic educational requirements of the various branches of engineering in which students are to find their careers? Is it possible to frame any general system of engineering education applying equally to the non-specialized engineer and to those who will pass into one of the score or more specialized branches of applied science; a system which will also embrace the operating, the industrial, the workshop engineer, etc., as well as the commercial, the sales, the publicity engineer, etc., and similar additions constantly being made, in name at least, to the engineering profession?

UNSYMMETRICAL POLYPHASE VOLTAGES AND CURRENTS.

The problem of determining the value of the current in a single circuit and its time-phase relation with respect to the voltage is a relatively simple one when the value of the impressed electromotive force and the character of the circuit are known. When, however, one must deal with several interconnected circuits upon which are impressed several separate but mutually dependent electromotive forces, whose values are determined by the character of the circuits, the problem becomes quite complex. In an article printed elsewhere, Mr. Charles H. Porter deals in a manner involving little complexity with the most general form of the problem encountered in three-phase circuits. Using the symbolic method, the author assigns to the e.m.f. impressed on each branch of a circuit a certain definite value and time-phase position, and thereby ascertains the current produced in the circuit of which the constants are known. The only feature of the demonstration liable to cause difficulty to the reader not already familiar with the facts, resides in the use of the symbolic method involving the apparent "factor" j. Although there may be few cases in which it is not preferable to express the relation in the form of algebraic equations involving the square root of the sum of the squares, rather than to employ symbolic equations using the equivalent quadrature-adding symbol j, in the present instance the method employed possesses the advantage of simplicity in distinguishing between condensive and inductive reactance, which are liable to be confused when plain algebraic equations are used. As illustrating the usefulness of the demonstration is the fact, brought forward by the author, that it is necessary to know the cyclic order in which three different impedances are arranged in three-phase star connection in order to determine the currents in the circuits. This relation can be shown by means of plain algebraic equations on graphical diagrams, but the work involved is somewhat greater than that required when the symbolic method is used.

Massachusetts Public Commissions News.

The Worcester Electric Light Company, through its president, Gen. Augustus B. R. Sprague, has appealed to the Massachusetts Gas and Electric Light Commission against a franchise granted by the Worcester Board of Aldermen, on July 14, authorizing the Connecticut River Transmission Company to erect and maintain poles and wires in the city of Worcester for the purpose of transmitting electricity for the use of power consumers. The franchise granted by the Board of Aldermen has a 28-year tenure and provides mainly that the Transmission Company may supply electricity to the Worcester Electric Light Company, electric railways, and to other customers whose motors and apparatus connected for use severally shall be of an aggregate rated capacity of not less than 15 electrical horsepower, and whose annual consumption shall not be less than 22,500 hp-hours. A provision is inserted to the effect that beginning with 1913 the Board of Aldermen may annually order ½ mile of line placed underground. General supervision of the work of the Transmission Company is assigned to the Worcester Commission on Wires and Electrical Appliances.

The above appeal follows close upon the recent important decision of the Board of Gas and Electric Light Commissioners authorizing the Connecticut River Transmission Company to sell electric power in the city of Fitchburg to installations of not less than 300 hp. The Worcester company's appeal follows along lines similar to that of the Fitchburg Gas & Electric Light Company, and appears to be based on substantially the same considerations. In view of the positive stand taken by the commission in the Fitchburg case in favor of limiting the local sale of power by the Transmission Company to 300-hp installations or over, or 20 times the capacity named in the Worcester franchise, it appears extremely probable that the same or similar restrictions will be placed upon the Worcester power market, and there would seem to be little doubt that the appeal of the Worcester company will be sustained, provided nothing of new and important bearing is introduced in the public hearings to be given later. It is understood that the Worcester company is not exercised over the possible sale of Connecticut River power to very large users, but that the appeal is taken to protect the company in that portion of the power field which it can serve most advantageously to the public and itself. No date for a hearing has as yet been set by the commission.

The Plymouth County Gas, Light & Power Company has petitioned the Gas and Electric Light Commission for permission to issue $600,000 of capital stock of the par value of $100 per share, and $400,000 of 5 per cent bonds at a par value of $1,000 each for the purpose of providing funds with which to construct its plant and acquire the necessary property. The company has been created under the laws of Massachusetts for the purpose of making, selling and distributing gas for light and for heating, cooking, chemical and mechanical uses.

For several weeks no street railway fare cases of importance have been brought before the Massachusetts Railroad Commission, but early in August a hearing will be given by the board to the Middlesex & Boston Street Railway Company, which operates lines in the Newtons and elsewhere, on the petition of the company to be allowed to extend the time during which an extra cent may be charged for transfer accommodations. About a year ago the commission approved the imposition of the additional charge for an experimental period of one year, and the company now comes before the commission with the statement that the earnings do not warrant the restoration of the free transfer on the lines formerly operated by the Newton Street Railway Company. General Manager Brush, who is well known as an able executive and close observer of electric traction operating costs and revenue, states that in order to secure, with the least burden upon the public, a proper and just return upon capital actually invested, it is necessary to continue to make the charge of 6 cents where the transfer is involved. It is probable that the hearing will bring out valuable additional information in relation to the expediency and necessity of charging for the transfer under definite conditions. Another fare case to be heard shortly is that of the Peabody-Salem Willows line of the Boston & Northern Street Railway Company. Here the issue is whether the company shall continue to charge 10 cents for a ride of about five miles on a line alleged by the petitioners to be well patronized, although it is questionable how profitable the traffic is during the winter season.

Connecticut Public Utility Bills.

Last week an account was given of the bill recommended by the majority, or nine members, of the committee of the Connecticut State Legislature providing for the establishment of a Public Utilities Commission; the text of a minority bill drawn up by two members of the committee was later published, some of the features of which are noted below.

The minority bill provides for a commission of five members with salaries of $4000 per annum each; the majority bill provided for three commissioners at a salary of $3000 per year each. The minority bill abolishes the Railroad Commission, vesting its power in the new commission, and provides that of the five members of the committee at least one shall be a lawyer, and at least another a civil engineer. Among the provisions of the minority bill are that the commission shall keep itself informed as to the condition of all construction and fixtures in public highways or elsewhere, and of all equipment of every company subject to its supervision, in so far as the safety of the public or the employees of such company may be involved; and it may order such repairs and alterations as are reasonably necessary for public safety or for the safety of employees. The commission is given power to investigate and make orders regarding the voltage at which electricity shall be distributed, and may upon petition cause any electric meter to be inspected. Upon petition that the rates or charges of a company are unreasonable, or the service furnished is inadequate, a hearing shall be held and the commission shall have power to make an examination of the books and financial condition of the company complained of, and of the condition of its plant and equipment. Should the commission after the hearing find that the rates and charges are unreasonable, it shall determine and prescribe what would be an adequate service and just and reasonable maximum rates, and the company thereafter shall not demand or collect any rate or charge for service in excess of that prescribed.

Nine sections of the act cover the issue of stocks and bonds, and five sections relate to appeals from decisions of the commission. A company is given a right to appeal to the Superior Court upon a question of the legality of any order, authorization or decision within 30 days after the filing of the same. The Court may hear the appeal and re-examine the question of legality, and proceed thereon in the same manner as upon complaints for equitable relief, its decision, however, to be subject to review on appeal to the Supreme Court of Errors on questions of law. Every appeal shall halt execution of the order or decision appealed from, unless at intervention of a court, which may at any time order that an appeal shall not so operate if in the opinion of the court it is brought for the purpose of delay, or if justice or equity of public service would be affected.

It is predicted that a situation will arise over the extension of the bill to include railroads which will prevent the passage of any public utility bill at the present session of the Legislature. The Senate is held by the supporters of public utility regulation to be under corporate control, while it is charged that the House is the most radical ever elected in the State, and there is little probability that the two bodies can come to any mutually satisfactory agreement. The question may be taken up in the campaign for the election of a United States Senator, in which case it is believed that Senator Bulkeley, one candidate, would support the minority bill, and that ex-Governor George P. McLean, another candidate, would advocate the majority bill.

Denver Wiring Ordinance.

A new ordinance to go into effect Aug. 1 requires all wiring construction for electric currents in Denver, Col., except electric bell and annunciator wires, to be installed in approved iron conduit. All additions or repairs to existing wiring and all wiring changed to comply with the city electrician's requirements for safety must be installed in iron conduit or, by written permission, in armored cable. In open wiring approved metal molding may be used.

Signs must be of all-metal construction, with all feed wires in conduit. Outlining may be installed in a complete metal casing with detachable front. Exposed telephone wires may be run open if bushed properly at floors and crossings, although all new interior wiring installation in mercantile buildings has been made in conduit for some years.

The advance in construction indicated by this ordinance is very great, as it eliminates entirely cleat wiring and concealed knob and tube. There has been the friendliest attitude on the part of the Denver Gas & Electric Company, the local contractors, the architects and the underwriters toward this improvement. Besides being the "City of Lights," Denver is rapidly gaining a unique position as a city of minimum electrical fire hazard.

Hydro-Electric Developments in California.

Several large hydro-electric developments have been brought to light recently in California, most of them in the central part of the State, and significance is attached to the fact that a great deal of the new work projected will be in the region of the Southern Pacific Company's new track improvements and the large tunnels that will be built through the Sierras to reduce the grade between Sacramento and Reno. It has been denied that there is any intention of electrifying the Southern Pacific Railroad on a large scale; although the company is said to be interested in the hydro-electric developments on the Rubicon and Yuba rivers. It has been known for some time that an electrical commission has been examining the water-power possibilities of the region tributary to the Southern Pacific mountain line, and also has been studying the economical aspects of operating the section by electricity.

The Rubicon project will be near Lake Tahoe, where the locations have been made on the Rubicon River, a tributary of the American River, by the Rubicon Water & Power Company. The preliminary engineering work of the proposition has been completed, and it is stated that the first power station will be built near Hale's Camp, in northern El Dorado County, and the second lower down on the Rubicon. The first will have a head of 1800 ft. and will develop about 30,000 hp.

On the Yuba River locations have recently been filed, which indicate that the water will be carried in flumes and canals from the North Yuba River in Sierra County, at a point below Sierra City, where the intake will be located, to the site of the power house, just below Downieville.

Another important development deal consists of the formation of a large water and power consolidation in the Sierras, which is to be incorporated under the name of the Lake Tahoe Power & Water Company, and in the development of which it is proposed to expend not less than $1,000,000 annually for the next four years. W. P. Hammon, the wealthy mining operator, and a syndicate of English capitalists and New York and Boston bankers are back of the project. It is stated they recently paid $3,000,000 to close the deal. The principal purpose of the syndicate is the development of power from the water of Lake Tahoe, of which it controls the only outlet. Transmission lines will be run on both sides of the mountains, supplying energy to the entire State of Nevada as far east as Ely, and on the California side to Sacramento, and through the valley of the Sacramento River.

At the same time it is announced that Mr. Hammon has reached an agreement with the U. S. Government whereby all of the suits in which the Interior Department had made him a defendant in the Federal courts in seeking to protect the Truckee-Carson irrigation project from the encroachment of Hammon on the waters of Lake Tahoe have been dismissed. The entire output of the plants, now combined, together with that which will be constructed near Lake Tahoe, will be developed to 200,000 hp. The concerns which have been consolidated by the Hammon syndicate are the Truckee River General Electric Company, the control of which Hammon recently purchased from the Fleischbackers; the California-Nevada Electric Power Company, which had been controlled by F. G. Baum and Francis V. Keesling, agents of Hammon, and the Loon Lake Water & Power Company, which has been in the hands of Chickering & Gregory.

It is stated that the Government has agreed, through the Secretary of the Interior, to a joint control of the outlet of Lake Tahoe, so that the Truckee-Carson irrigation project and the power development by the new corporation will be carried out under an agreement by which Hammon will secure the right to use the water under certain regulations by the Government which it is considered will protect the interests of the Federal irrigation project in Nevada.

One of the first parts of the construction work to be undertaken will be the long transmission line to Ely, Nev., where the Hammon corporation is to furnish energy to the smelters. This will not only be one of the longest transmission lines, but it will also carry a load of 10,000 hp.

In addition to furnishing energy to Reno and Sparks, the new corporation, through the California-Nevada Company, is supplying electricity to the mines at Tonopah and Goldfield, and has the control of the market in the entire State. This, together with the transmission line into the Sacramento Valley, will give the company a field from the eastern border of Nevada to Sacramento.

The greatest part of the energy sold in Nevada will be developed from the Carson and Walker rivers, while the engineers have plans for new power stations in the Truckee, where three stations are already in operation.

It is rumored that the Lake Tahoe project consists in driving a tunnel about nine miles in length in a westerly direction, opening on the Rubicon River at Hell Hole, where a drop of 2000 ft. can be obtained. This is near the point of the Rubicon Water & Power Company's developments, and a conflict of rights between the two interests may arise.

The engineering work of all the Hammon plants is in the hands of Frank G. Baum, formerly engineer for the California Gas & Electric Corporation. Mr. Baum has already increased the output of the Truckee River plants by 1000 hp, through changes in the engineering features of the system.

The Bay Cities Water Company is also said to have favored a large water-power proposition on the American River, where $12,000,000 will be expended in developing about 75,000 hp. The engineering work is in the hands of Duryea, Haehl & Gilman.

The management of the Great Western Power Company is in the efficient hands of Mr. H. H. Sinclair, formerly vice-president and manager of the Edison Electric Company, of Los Angeles. The former company has closed a contract with the Southern Pacific Railroad by which it will supply energy to supplement the railway company's new steam plant now building in East Oakland, for the operation of the new electric suburban train service in Alameda, Oakland and Berkeley. Mr. Sinclair says that $2,000,000 will be expended by the Great Western Power Company in the next two years, in addition to the $8,000,000 already invested and that the ultimate improvements planned will represent an outlay of an additional $20,000,000. He stated that the company is building for the future, and within 10 years it will be equipped to supply 500,000 hp, where it is now supplying 60,000 hp.

Considering the above-mentioned power proposition and the many other smaller new schemes and the large improvements to existing properties, it is seen that the power developments now being worked out in the Sierras are of a magnitude that will call for the expenditure of very close to $50,000,000.

Niagara Turbine Disabled.

One of the new 10,000-hp turbines in power house No. 3 of the Niagara Falls Hydraulic Power & Manufacturing Company broke down on Sunday afternoon and two employees were injured. The casing burst, and a piece of metal was hurled across the station, which was partly flooded with the outrush of water. At the time the wheel was moving under about 75-lb. pressure, but has successfully withstood much higher pressure. A defect in the casting is suspected as being responsible for the break.

New York Public Service Commission News.

The question of a 5-cent fare on the Coney Island & Brooklyn Railroad Company is still before the Public Service Commission of the First District. The commission has rendered no decision on the complaint of J. Monheimer, a resident of South Brooklyn, demanding that a 5-cent fare be established for every day in the week, instead of permitting it to be raised to 10 cents on holidays and Sundays. Last week August Kleb, a resident of Brooklyn, applied to the Supreme Court for a peremptory writ of mandamus compelling the commission to issue an order putting into effect a 5-cent rate. The court took the matter under advisement, but said that unless the commission had already decided in favor of such a rate it would be powerless to issue the writ.

The hearings concerning the franchise rights of the electric light and power companies in the metropolitan district of New York have been discontinued temporarily, owing to the absence of Commissioner Milo R. Maltbie. They will be resumed in August.

The New York Public Service Commission of the Second District has made an order requiring the Red Hook Light & Power Company, of Red Hook, Dutchess County, to show cause at Albany on July 28 why it should not provide suitable apparatus for testing electric meters, as required by the commission, and a similar order requiring the Riverhead Electric Light Company to show cause before the commission at Albany on July 28 why it should not immediately put in proper shape to serve the public its plant and distributing system, an inspection of the plant disclosing the fact that it is in such disrepair as to be a constant source of danger and menace to the public. The commission has also served an order upon the Hallet Electric Light & Power Company, of Riverhead, Suffolk County, to show cause before the commission at Albany on July 28 why it should not put its plant and distributing system in proper shape to give satisfactory services to the public. An inspection of the property by a representative of the commission disclosed that it was in a state of disrepair and was a menace to the public.

The Mexico Electric Light Company, of Mexico, Oswego County, has been directed to submit to the commission on or before July 31 a statement showing repairs and improvements made to its distributing system in accordance with the recommendation of the commission, with particular reference to number, size and location of new poles set in the village and elsewhere, and the number, size and location of new cross-arms which have been installed.

The Suffolk Gas & Electric Light Company has been authorized to execute to the Kings County Trust Company, of the Borough of Brooklyn, a mortgage upon all of its property, etc., to secure an issue of 5 per cent gold bonds to the amount of $500,000. The company is authorized to issue at once $200,000 to be used for the refunding of a like amount of bonds maturing May 1, 1918, the bonds to be exchanged par value for par value. The company is further authorized to issue bonds to the amount of $150,000, to be sold at not less than 90, to be used for the installation of new gas apparatus, new buildings, engine, two generators, boilers and a gas holder with a capacity of 350,000 cu. ft., 1½ miles of additional 8-in. main, 4 miles of 6-in. main and 5 miles of 4-in. main.

Mexican Electrical Developments

It is projected to use the rapids of the Balsas River in the State of Guerrero to generate electric power for transmission to Mexico City and a number of towns and industrial centers, particularly mining camps, within a radius of 100 miles of the proposed plant. It is stated that more than $5,000,000 gold will be expended in the installation of the generating and transmission systems. The surveys and estimates which have been made are said to show that more than 60,000-hp can be developed. The Alfredo B. Adams Company, of Mexico City, is financing the project. It is proposed to start the construction work as soon as the rainy season closes. It is expected that this cheap power will cause the opening of many new mines in the territory reached by the transmission lines, as the high cost of fuel in that region makes it unprofitable to work low-grade mines.

The demand for electric power in the city of Pachuca and the many mines and mills of that section is so great that the Compania Electrica y Irrigadora, which already has a hydro-electric plant of 8000 hp in operation at Peublo, is preparing to install an additional plant of 6000 hp at an estimated cost of $2,000,000 Mexican currency. It is stated that orders have already been placed for all this additional power. The new plant will be located at Tetepango, State of Hidalgo. It is planned to have it finished and ready for operation within 12 months.

Mr. W. C. Simmons, of Guadalajara, has finished the surveys for a hydro-electric plant which the Sombrete Mining Company proposes to erect on the Durango River in the State of Zacatecas. It is planned to develop 10,000 hp at this plant and to transmit the electrical energy to the towns and mining camps of Zacatecas, Sombrete, Chilchihuites and Nieves. It is one of the most important electric power projects in Central Mexico and if achieved will mean much for the mining industry of the districts which are to be supplied with the cheap power. Mr. Robert S. Towne, the well-known smelter magnate of Kansas City, Mo., and San Luis Potosi, Mexico, is president of the Sombrete Mining Company. The primary object of the proposed hydro-electric plant is to furnish the mines and reduction mills of the Sombrete Mining Company at Sombrete with electric power, but there will be sufficient surplus to distribute over a wide territory.

The Southern Pacific Railway Company of Mexico has installed a large electric power plant at the town of Empalme, State of Sonora, where its new shops and general offices are situated. The town of Empalme is being built by the railroad, and it is planned to make it a model city in every respect. The electric power plant also furnishes lights for the town.

The Mexican Northern Electric Company has started the construction of the great dam across the Conchos River, near Santa Rosalia, State of Chihuahua, which is to form the basis for operating its proposed hydro-electric plant at that place. A minimum of 24,000 hp will be developed by this plant. The dam will also form a water storage reservoir for the irrigation of about 250,000 acres of valley lands by the company. The survey has been made for an electric railway which will be built from Santa Rosalia to the site of the hydro-electric plant, a distance of 17 miles. The transmission lines will run to the mining districts of Parral, Santa Eulalia, Naica and to the cities of Chihuahua, Jiminez, Santa Rosalia and other places. It is claimed that by the introduction of electric power in mining operations a saving of at least $3 per ton on mining and milling the ore will be obtained.

The Chapala Power & Irrigation Company has had a survey made for the canal that is to be built from the waterfalls of Juanacatlan on the Santiago River to Las Juntas, a distance of about 15 miles, where the water will be made to drop 1800 ft., thereby enabling about 90,000 hp to be developed. The electric power will be transmitted to the city of Guadalajara and to Lake Chapala, where it will be used to operate large irrigation pumps. It is also planned to transmit the electric power from this proposed hydro-electric plant to the cities of Aguascalientes and Zacatecas, more than 200 miles distant.

Street Lighting Experiments by Chicago Park Commissioners.

The South Park Commissioners of Chicago, who have under their jurisdiction Washington Park, Jackson Park, Grant Park and various new parks, with connecting boulevards, are conducting an interesting series of experiments in street lighting on Michigan Boulevard between Randolph Street and Twelfth Street, in the downtown portion of that city. Erected on temporary posts and with temporary wires, in the case of electric lamps, several different types of lamps have been installed to observe the effect of the illumination and to determine how high the lamps should be located, how far apart they should be spaced and other considerations of like nature. The lamps under test or about to be tested are gas lamps with incandescent mantles, enclosed arcs, magnetite arcs, flaming arcs and 100-watt tungsten incandescent lamps. In addition 12 (six on each side of the street) flaming arcs will be installed on Jackson Boulevard, between State and Dearborn Streets. These will be suspended from brackets attached to the buildings and will be about 35 ft. above the street. The Commissioners hope to obtain valuable information by observing the performance of these various lamps, and the results of the tests will be of value in planning the future illumination of the South Side parks and boulevards, with the view of giving Chicago the best obtainable lighting of this character. In the new Grant Park alone it is estimated that 1,000,000 kw-hours per annum will be required for lighting. Mr. John A. Radford is the consulting engineer for the South Park Commissioners.

National Electrical Contractors' Convention.

The National Electric Contractors' Association of the United States held its ninth annual convention at Toledo, Ohio, July 21 to 23. The Boody House was headquarters and the sessions were held in the auditorium of the Chamber of Commerce. The first two days were given over to meetings and the third to an outing trip to Sugar Island. The morning sessions were open to members and guests; the afternoon sessions were executive and for members only. The first morning session was called to order by Mr. M. W. Hensen, president of the Ohio Electrical Contractors' Association, who welcomed the convention on behalf of the State association. He was followed by Mayor Whitlock in an address of welcome from the city. President G. M. Sanborn then took the chair and presided over all of the sessions. There were two addresses at this Wednesday morning session. One was by Mr. W. H. Blood, Jr., of Boston, who spoke on "The National Electric Code and the Relation of the Contractor to the Central Station." Mr. Blood represented the National Electric Light Association, of which he is the insurance expert. Following this address was one by Mr. George C. Nimmons, architect, Chicago, on the relation between the contractor and the architect.

Mr. Nimmons called attention at length to the inherent defects in our present system of letting and carrying out contracts in which the chief aim of each contractor is to put as little money as possible into a job. This evidently struck a responsive chord among the contractors, as it received more discussion than any other address given before the convention. After this discussion a motion of thanks to Messrs. Blood and Nimmons was passed and the session adjourned.

At the Thurday morning session Mr. P. Bissell spoke on "Co-operation Between the Electrical Jobbers and Electrical Contractors" on behalf of the Electrical Supply Jobbers' Association.

Mr. E. Leavenworth Elliott, of New York, spoke on "The Contractor and Illuminating Engineering," calling attention to some practical benefits the contractor could derive by a knowledge of illuminating engineering.

Mr. James R. Strong, of New York, ex-president of the association, read a paper on "The National Electrical Contractors' Association," in which he called attention briefly to some of the things the association had accomplished, but he devoted his paper more particularly to some of the things which the association had not accomplished, and to which it should bend its energies. This finished the business of the second and last open session.

In the executive sessions the association decided to publish a data and sales book which is intended as a guide to retail prices of all electrical supplies. This is to be really what might be called a standard price book, giving the retail and wholesale or quantity prices on all the common devices used and sold by the electrical contractor and dealer. The prices given are to be the common prevailing prices, and are not, of course, to be obligatory on any of the members, as a member may sell at a higher or lower price, as he may desire. The book is intended rather to be a guide as to prevailing reasonable prices, and as such should be of considerable value. This book will be issued by the secretary, Mr. W. H. Morton, of Utica, N. Y. It will be issued only to contractors who are members of the association. The book, the expense of which to revise and publish will be considerable, will be on the loose-leaf plan, so that it can be revised and kept up to date.

A resolution was also adopted recommending to manufacturers and jobbers that catalogs, leaflets and price lists be made a standard 6-in. x 9-in. size, which is the size already adopted by many manufacturers.

The officers elected for the ensuing year are the same as those for the past year, and are as follows:

President, Mr. G. M. Sanborn, Indianapolis, Ind.; first vice-president, Mr. M. L. Barnes, Troy, N. Y.; second vice-president, Mr. Chas. R. Kreider, Chicago, Ill.; third vice-president, Mr H. S. Potter, Boston, Mass.; treasurer, Mr. John R. Galloway, Washington, D. C.; secretary, Mr. W. H. Morton, 41 Martin Building, Utica, N. Y.; sergeant-at-arms, Mr. J. C. Stearns, Buffalo, N. Y.

The directors from the various States for the following year are as follows:

Messrs. J. T. Marron, Rock Island, Ill.; Ernest Freeman, Chicago; F. H. Cheyne, Indianapolis, Ind.; Seth B. Wetherbee, Boston, Mass.; J. J. Thorne, Bay City, Mich.; Wm. Burgess, Duluth, Minn.; Chas. J. Sutter, St. Louis, Mo.; P. N. Thorpe, Passaic, N. J.; James R. Strong, New York City; M. L. Barnes, Troy, N. Y.; James Hilton, Syracuse, N. Y. The next convention of the association is to be held at Atlantic City, July 20 to 21, 1909.

Wednesday evening banquets for both ladies and gentlemen were given at the Boody House. Tuesday evening the Sons of Jove held a rejuvenation. On Friday the entire party went by steamer to Sugar Island, at the mouth of the Detroit River. The weather was not very favorable on account of wind and rain in the morning, but it cleared sufficiently to permit the annual baseball game between the contractors of the East and West in the afternoon. The official score-keeper of this game declared that there were only two errors, although to the spectators it appeared differently. The score stood 3 to 5 in favor of the Western contractors when the players got tired and quit.

Mr. William Burgess, of Duluth, policed the grounds with a big stick and prevented the rooters from annihilating Umpire John R. Galloway, of Washington, D. C. After the official game some of the younger bloods of the convention had a real baseball game for a diversion. From Sugar Island most of the party went back by steamer to Toledo, some going to Detroit.

Registration of members and guests was about 225. The number of members (contractors) registered was 78, which is considerably more than last year, although the total registration was higher last year at Chicago, because it was held in a large city.

THE NATIONAL ELECTRICAL CODE AND THE RELATION OF THE CONTRACTOR TO THE CENTRAL STATION.

Mr. W. H. Blood, Jr., in his address on this subject said that the code, the contractor and the central-station company taken together represent fairly well the entire electric lighting industry. They constitute the triumvirate of the industry. No one of these has unlimited power, but each is a check on the others, and all are automatically controlled by financial limitations. If the company's lighting rates are too high, the consumer turns to gas or oil. If the contractor tries to make undue profit the consumer refuses to use electricity. If the code requirements are unnecessarily severe, it has the same effect.

Previous to 1895, because of the diversity of rules of installation no such thing as uniformity in practice existed. As a result of a general agitation of the subject, a national conference on standard electrical rules met in New York, March 18, 1896, at which a large number of electrical and allied bodies were represented. The N. E. L. A. presented at this conference a large pamphlet prepared by Mr. W. J. Hammer, showing in parallel columns the rules of the N. E. L. A., the National Board of Fire Underwriters, the Associated Factory Mutual Insurance Companies, the Phoenix Fire Company and the English Board of Trade. Following this conference, in 1897 the first edition of the National Electrical Code was sent out. This code is published by the National Board of Fire Underwriters and has been regarded as their property. While these are the Underwriters' rules, the code is national in scope as well as in name, and the Underwriters welcome frequent conferences with practical men all over the country who are installing wiring and furnishing electric current. The annual conferences which the underwriters hold in New York, and to which all interested are invited, have been productive of great good to the entire electric lighting industry. The committee has been glad to take advice from the able men of the contractors' association. When such experts as its president, Mr. G. M. Sanborn; its secretary, Mr. W. H. Morton, and Past-Presidents Messrs. E. McCleary and Jas. R. Strong speak, their suggestions are worth listening to. Attendance at these code committee meetings tends to broaden any man, and the individual who comes with the intention of grinding a personal axe or trying to secure the endorsement of some freak idea of his own soon finds that he is out of place, and quickly learns that the conference is too busy determining what is best for the industry as a whole to listen to personal trivialities. The rules of the code have been modified from year to year, and are now like any code of rules which have been frequently revised without being re-codified. The new re-codified edition, which is soon to be published, will relieve this condition of affairs.

Lack of uniform interpretation of the rules has been a serious annoyance to contractors and to electric-lighting companies. The Underwriters are making earnest and effectual efforts to correct mistakes caused by inefficient or prejudiced inspectors. The issuance of supplementary rules by local underwriting boards which render inoperative some of the provisions of the code are discountenanced and even forbidden by the National Board of Fire Underwriters.

Electric-lighting companies cannot afford to have cheap or unsafe work done, nor can they permit the expense of getting ready to use the current to be so great that it will scare off prospective customers. A wiring job which costs $2 per outlet produces as much revenue for the electric-lighting company as one costing $4 or $5 per outlet. It would be short-sighted for the contractor to insist upon expensive work when the cheaper form of installation would be fully as satisfactory. To popularize the use of electricity should be the aim, and no stumbling blocks should be placed in the way by the contractor. There has been in the past too much friction between the company and the contractor, and the question of whether or not the electric lighting company shall do inside wiring is still a mooted one. Few electric-lighting companies of their own volition take up this line of business, unless they are forced into it. It is not infrequent that electric-lighting companies exist in cities which are too small to support a competent wiring contractor, and we frequently find a man in such localities without a reputation and without a conscience who will put in any kind of a job so long as he can get his money for it. If a number of contractors should get together and arbitrarily fix the price of wiring installations at a high rate during a time of active building operations in a given city, one can readily see that permanent injury would be done the lighting company, for the new buildings would go up piped for gas with the electric wiring left out. The electric-lighting company must for its own salvation see that all new buildings are wired, and to do this the price must be reasonable and the work honest. On the other hand, the electric-lighting company sometimes fails to realize that the contractor and his employees constitute a very efficient corps of salesmen for it. There should be the closest co-operation between the central station and the contractor.

RELATION BETWEEN CONTRACTOR AND ARCHITECT.

Mr. George C. Nimmons, of Chicago, in his address on the foregoing subject, said that the electrical work is the youngest of the various trades entering into building construction, but it has come to be very important. He then went into the modern methods of carrying out work through the architect and contractor. Although the architect is an artist, he does not, like the sculptor or painter, execute and carry out the work himself. The architect must depend on the builder and contractor—so that much relies on the contractor.

In ancient Greece there was no distinct line between the contractor and the architect. The architect drew up plans and made estimates on the cost of the building, and was held responsible for the cost. If the actual cost exceeded 25 per cent of the estimated cost the architect had to pay the difference out of his own pocket. If the cost was equal to or less than the estimated cost the architect got his fees and much praise. The aim, however, was to produce high-grade work rather than secure low cost. Under the present system of handling work under which low cost is given the first place, all the ambition to excellence on the part of the contractor is killed.

The aim of the contractor under the modern competitive bidding system is necessarily to put up buildings at as low a cost as possible, or, in other words, to keep as much money out of the building as possible and still bring it under the promise of the contract. This influence goes down through the contractor to the foreman and workman, and the best men under this system are those who can turn out the greatest amount of work of a quality which will pass the architect's superintendent. The interests of the owner or architect and those of the contractor and builder are necessarily antagonistic.

Mr. Nimmons also called attention to the great waste of labor in the average building contractor's office in Chicago in making bids and estimates on work which is not secured. This cost of making estimates for competitive bids he figured from apparently reliable sources is from 2 to 3 per cent of the entire cost of building operations in Chicago. In other words, each contractor has to add this expense of maintaining an estimating force. Each contractor secures in Chicago about one job to every seven bid upon, so that six-sevenths of this estimating labor goes to waste and has to be added to the cost of each building.

The owner favors the competitive bidding system and the letting of general contracts to lowest bidders, because the owner under this arrangement takes no risk. The owner may be sure, however, that if he is not willing to take risks, neither is the contractor. Therefore, the contractor will fully protect himself in whatever bids he makes, and will make his bids high enough to cover what he thinks is the maximum first cost of the work. Workmanship has a constant tendency to deteriorate under such a system.

A number of plans have been proposed to improve these conditions. It is not likely that any one person will solve the problem, but that the improvement will be the result of many suggestions and ideas. Among the plans which have been suggested are the cost plus a percentage contract; the premium contract, and the cost plus a fixed sum contract. All of these

are efforts in the direction of improvement. If the percentage contract is used, the percentage should also be distributed among sub-contractors as well as to the general contractor, because the sub-contractors have the workmanship directly under their charge. Whatever the plan, the architects' and contractors' aims should be the same—namely, to produce excellence of work instead of the reverse, as at present.

In discussion, Mr. J. R. Strong, of New York, inquired of Mr. Nimmons his opinion as to the effect on the quality of buildings of having a general contractor who sub-contracts. Mr. Strong said that the electrical contractor is one of these sub-contractors who was recently referred to in a contractors' meeting as belonging to one of the insignificant trades, all of which trades are necessary to a general contract. Mr. Nimmons in reply pointed out that the general contractor of necessity becomes skilled in hammering down the bids of various sub-contractors, and getting these sub-contractors to work on the least possible margin. The general contractor cannot be blamed; it is the scheme that is wrong.

Mr. Wm. Burgess, of Duluth, told of one general contract let recently in which the bidder was obliged to specify the names and bids of the various sub-contractors in order that there might be no beating-down process to the detriment of the work after the general contract was let.

Mr. C. R. Kreider, of Chicago, said that his firm will not make estimates for general contractors with the exception of a very few concerns. This is on account of the beating-down process which the general contractor expects to go through after he gets his contract. This concern prefers to deal directly with the owner and architect. He also referred to the practice which is common of specifying a certain make and type of device "or its equal." He recently pointed out to an engineer that this opened the way to considerable annoyance later by the substitution of goods claimed by the contractor to be equal, and that it is much better to specify any one of a certain number of satisfactory brands.

THE NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION, TRADE RELATIONS, ETC.

Mr. James R. Strong, of New York, ex-president of the association, spoke briefly of the work which the association had accomplished since its organization in 1901. Among the troubles which had been partially smoothed out with the aid of the association were the variations in the interpretation of the National Electrical Code in different parts of the country, the competition of central-station companies where there should have been co-operation, and assistance to members in connection with labor troubles. However, he said that he wished to speak more particularly as to things which the association had not done, but which could profitably be considered in the future.

One of these things is the more active interest of a larger percentage of the membership in the routine work of the association and the securing of more new members by present members. The association can also be of considerable assistance to its members by the exchange of information on customers of poor credit.

He then took up the relations of the association with manufacturers and jobbers, giving his personal opinions as to the ultimate solution of many of the troublesome questions which have come up in the contractors', jobbers' and manufacturers' associations in the past few years.

He laid down several principles of trade as fundamental, and as certain to prove true in the long run. One of these principles is that unnecessary profits can never be maintained for any length of time. Another is that agreements and resolutions cannot be made to form artificial division lines between different classes of trade. The only division line possible that can be permanently established, as evidenced by the experience of many years in other trades, is the line between wholesale and retail trade; or, in other words, the basing of prices on quantity. Contractors and others have failed to recognize in the attempts they have made in the past, the principle that quantity must necessarily govern the price, and that any other method of regulating prices is artificial and cannot survive in the natural course of the trade, under the pressure of competition. In other words, he said, "give us all the same price for the same quantity." Natural laws of trade must govern. The middleman will exist only where there is a good economic necessity for his existence.

CO-OPERATION BETWEEN ELECTRICAL JOBBERS AND CONTRACTORS.

Mr. Fred P. Bissell, of Toledo, in his paper on this subject, said that co-operation is much to be desired, and is outlined by the contractors' association resolution which says that "The natural course of merchandise is from manufacturer to jobber, then to the contractor or central-station, and finally to the consumer. Both the jobbers' and contractors' associations are committed to this policy. That it is advantageous to the contractor to buy from the jobber is an old statement growing stronger every day. The jobber makes a depot from which the contractor can draw assorted items on demand; makes a few shipments of many items; relieves the contractor of large investments in merchandise and gives financial favors to the contractor. One of the first troubles is found in the jobber who does a construction business or runs a construction department, and then there are contractors who attempt a jobbing business, yet who retain their construction business. Both of these men are detriments to their respective associations, and have been the cause of the most serious obstacles in the working out of this problem. The contractor points with disgust at the curbstone operator with the proverbial screwdriver and coil of annunciator wire, and is unable to see how the little fellow can get stuff at the big contractors' prices. Yet he fights vigorously and sometimes viciously against a quantity price himself, endeavoring to buy one article at the price of 100. There is not a man in either association who was not once small and who was entitled to and had his chance and the right to prosper if he showed ability, and nothing short of that is thought of to-day; nor will the economies of business regardless of legal objections ever permit anything different.

The price for quantity always has made a difference and doubtless always will, but what can be urged further than that, and what distinctions may be made to conform to divisions of business, no one is prepared to say. The contractor who fights the jobber and the contractor who tries to become a jobber and a contractor at the same time, and the jobber who does contracting are alike equally guilty of being obstacles in the road to co-operation.

Too many irons in the fire is bad practice, and few can keep more than one hot at a time. If many irons be possible, what is to prevent the growth of an octopus which will manufacture, job, retail and construct all over the country, with branches in all important points, big and little? Are we drifting that way?

Along this line of investigation it may be well to ask if the jobber is really a business necessity. It may be well to consider that no one who is useless endures. The progress of events takes him out. From earliest history merchants who bought in bulk and sold in broken lots have been common. Some things to-day go from manufacturer to consumer, but not many. When the jobber ceases to be useful he will vanish. It may be helpful to appreciate that vanishing is not a monopoly.

The store-counter trade in the electrical business is a feature to which much attention can be given. This requires a selling organization consisting largely in promptly answering the telephone, keeping the store new and bright, with reasonably good window and counter displays, cleanliness of store, proprietor and clerks, knowledge of the business, and courteous and reasonable advertising.

Perhaps the greatest enemy to the contractor's success if he is a retailer is the unwise attitude adopted by some central-stations of giving away articles which consume current. It would be more logical for the central station to lower the price of current.

The manufacturer cannot be a jobber, nor a contractor, nor a retailer unless he assumes all the responsibilities, risks and expenses which go with those divisions of the business. When he does assume them the exclusive jobber and the exclusive contractor can always beat him.

Westinghouse Annual Report.

The annual report of the Westinghouse Electric & Manufacturing Company has been issued to stockholders in pamphlet form under date of July 28. The report covers the year ending March 31, 1909. In a statement preceding the financial tables Mr. George Westinghouse, president, states that the affairs of the company were taken out of the hands of the receiver Dec. 5, 1908, the present board elected Nov. 30, 1908, the officers of the company appointed Dec. 7, 1908, and the executive committee elected on Jan. 5, 1909. The board was not permanently organized, however, until the election of Mr. Robert Mather, as chairman, on Jan. 19. The time intervening has been required to complete the adjustments resulting from the receivership, and the readjustments of the debt of the company, and to determine the readjustments to be made with reference to the company's business in America.

The loss from operation of the business during the past business year was, after providing for interest charges and making a fair allowance for depreciation, $918,682. The expenses incurred in connection with the adjustment of the debt which existed Oct. 23, 1907, were $460,490. The compensation and expenses of receiver and attorneys amounted to $265,383. Sundry accounts charged off to reduce the book value of the company's assets, such as discounts and expenses incurred in connection with bond issues of previous years; depreciation of patents; depreciation of various stocks and bonds; provision for possible losses on inactive finished parts and machines on hand at the close of the year, and other minor items of a similar nature, amounted to $1,347,605. The total of the above is $2,992,661, which represents the decrease in the surplus account during the year.

The report states that the loss of $918,682 after providing for interest upon the debt and all expenses is chiefly accounted for by a small volume of business, the utilization of high-priced material, by sales at reduced prices, and by a very considerable extra expense incurred in completing the departmentalizing of the manufacturing operations of the company and the rearranging of machinery, which work was carried on without interruption by the receivers. The result of these important changes in manufacturing methods have been to reduce greatly the amount of material, raw, in process and finished, required to be kept in stock for a given amount of output, and also to greatly increase the space available for manufacturing operations. The amount of material in stock, work in progress, goods on consignment and apparatus with customers, on March 31, 1909, was $9,961,182.32, as compared with $17,740,178.32 on Oct. 23, 1907, when the receivers were appointed.

The company received from stockholders, merchandise and other creditors, subscriptions to capital stock at par amounting to $12,778,825; to 5 per cent convertible bonds at par amounting to $3,586,000; and to four, five, six and fifteen-year notes $1,392,150, making a total of new capital raised at par by the sale of stock and securities of $17,756,975. It is estimated that the plants of the company have an annual output capacity of $50,000,000, and that the cash capital thus provided is ample for conducting a business of that magnitude.

Under the provisions of the convertible bond indenture the company is required to provide a sinking fund of $500,000 annually and to invest the same in its convertible bonds. Since the termination of the receivership the company has turned into the sinking fund $1,500,000, covering the requirements up to the end of the present calendar year. This sum was invested in convertible bonds yielding a profit of $105,478.76.

It is stated that while there has been a decided improvement in the business of the company since the beginning of the year, it has not yet nearly reached normal proportions, although the outlook and inquiries indicate that in the near future the full capacity of the various works will be required to meet the demand.

The general balance sheet and statement of income and profit for the year ended March 31, 1909, are printed herewith.

CONSOLIDATED GENERAL BALANCE SHEET.

ASSETS.

Property and Plant: Factory plants, including real estate, machinery, equipment, etc.		$14,578,389.62
Sinking Fund: With trustee for redemption of convertible sinking fund, 5% gold bonds		48,234.38
Investments: Stocks, bonds, debentures and collateral trust notes of other companies, including affiliated European and Canadian Westinghouse companies		29,844,288.62
Current Assets:		
Cash	$10,297,934.52	
Cash—Special deposit	1,535,120.00	
Cash on deposit to pay bond coupons	24,040.00	
Notes receivable	3,650,999.10	
Accounts receivable	6,951,790.09	
Due from subscribers to capital stock	1,166,280.19	
		23,626,163.90
Working and Trading Assets: Raw materials and supplies, finished parts and machines, work in progress, goods on consignment, and apparatus with customers		9,961,182.32
Other Assets: Charters, franchises, patents, insurance and taxes paid in advance, etc.		6,827,212.10
Total assets		$84,885,470.94

LIABILITIES.

Capital Stock:		
Preferred	$3,998,700.00	
Assenting	36,636,125.00	
Non-assenting	600.00	
		$40,635,425.00
Funded Debt:		
Convertible sinking fund, 5%, gold bonds, due Jan. 1, 1931		$20,532,251.75
Debenture certificates, 5%, due July 1, 1913	1,969,000.00	
		22,501,251.75
Collateral Notes:		
Six per cent collateral notes, due Aug. 1, 1910	6,000,000.00	
Five per cent collateral notes, due Oct. 1, 1917	2,702,702.70	
		8,702,702.70
Four, Five, Six and Fifteen-Year, 5% Notes: Issued under readjustment plan.		1,392,150.00
Subscription: To capital stock of Societé Electriqué Westinghouse De Russie		347,500.00
Current Liabilities:		
Notes payable	$125,000.00	
Accounts payable	1,168,790.66	
Interest, taxes, wages, and rebates accrued, not due	481,681.93	
		1,775,472.59
Reserve: For inactive materials and supplies, adjustments of production orders and accounts receivable		550,634.21
Profit and Loss: Surplus		8,980,334.69
Total liabilities		$84,885,470.94

CONSOLIDATED STATEMENT OF INCOME AND PROFIT AND LOSS.

Gross Earnings: Shipments billed		$20,606,592.04
Cost of Shipments: Factory cost, including all expenditures for patterns, dies, new small tools, and other betterments and extensions. Also inventory adjustments and all selling, administration, general and development expenses		19,955,808.51
Net Manufacturing Profits		$650,783.53
Other Income:		
Interest and discount	$362,383.85	
Dividends and Interest on sundry stocks and bonds owned	782,315.75	
Miscellaneous..Royalties, etc.	170,775.52	1,315,475.12
Total Income		$1,966,258.65
Deductions from Income:		
Interest on bonds and debentures	$1,056,807.95	
Interest on collateral notes	496,515.19	
Miscellaneous interest	647,448.17	
Property and plant depreciations charged against income	513,316.14	
Miscellaneous	170,854.11	2,884,941.56
Net Income—Deficit		$918,682.91
Profit and Loss Credits:		
Profit and loss—surplus, Mar. 31, 1908..	$11,972,996.49	
Profit on bonds purchased and retired through sinking fund	105,478.76	
Miscellaneous	27,994.33	12,106,469.58
Gross Surplus		$11,187,786.67
Profit and Loss Charges: Compensation and expenses of receivers and attorneys; expenses in connection with adjustment of debt; depreciation of patents; proportion of discount on bond issues of previous years written off; reserve for possible losses on accounts receivable and inactive machines and parts, and other items appertaining to prior years or of an extraordinary nature		2,207,451.98
Surplus, March 31, 1909, per Balance Sheet		$8,980,334.69

Wisconsin Rate Commission News.

The Wisconsin Railway Commission on Wednesday had a hearing on the petition of F. C. Fullmer, of Scofield, for an order requiring the Wausaw Electric Railway Company to furnish better service and reduce its rates.

The Chippewa Valley Railway, Light & Power Company has granted authority to issue $35,000 in first mortgage 5 per cent gold bonds, to cover cost of plant improvements.

Authority has been granted the Superior Water, Light & Power Company to issue $200,000 in gold bonds, and also to the Waukesha Gas & Electric Company to issue $600,000 in 5 per cent gold bonds.

The accounting department has prepared a standard form of annual report for each of the three classes of telephone utilities, and one for the utility as a whole. The Wisconsin Telephone Company, which operates over 60 exchanges in the State, will, therefore, be required to submit annually over 60 separate and complete reports—one for each exchange and one for the company as a whole. With the completion of the standard report form for the electric railways, every class of utility will have its form of annual report, and the uniform system of accounting necessitated by these reports will enable the commission to compile comparative data concerning the various features of plant management which should be of great assistance in the regulation of rates and quality of service rendered.

Manufacture of Metallic Filaments.

A patent granted July 13 to Werner von Bolton, of Charlottenburg, Germany, describes a process for the manufacture of tantalum, tungsten and other metallic filaments, in which process a ductile metal, such as copper or nickel, initially enters.

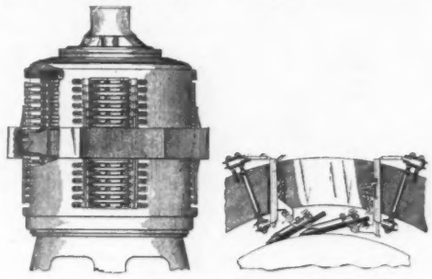
The specifications state that in order to be able to bring metals which in themselves alone can only be molded with difficulty, as, for example, tantalum, tungsten, molybdenum, into the form of filaments for electric incandescent lamps, metal is embedded in a state of fine division in another metal, as, for example, thorium, gold, copper, aluminum and particularly nickel, in such a manner that each of the finest particles of the refractory metal is inclosed by a casing of the other metal. The metallic mass thus obtained is then wrought into the form of filaments mechanically by rolling or drawing, or under certain circumstances by pressing, squirting or the like, whereupon the inclosing metal may be removed by mechanical or chemical means or by vaporization.

One metallic powder can be embedded in another ductile metal in many different ways, as, for example, by the metallic powder being put into a molten mass of the other metal and distributed uniformly in the latter; or by a powder of the one metal being intimately mixed with a powder of the other metal and afterward united by pressure. During the application of pressure to the mixed powder, the ductile metal yields and unites into small plates which cohere and form a covering or casing for the non-ductile metal. The union can also be effected in the latter case by the mixture of metallic powders being subsequently heated in such a manner that the ductile metal, which is supposed to be less refractory, is converted into one cohesive mass by its parts being welded or sintered together, or by its parts being united in a melted state, which cohesive mass envelops the particles of the metallic powder of the highly refractory metal.

When it is desired to remove the enveloping metal, this can be done, if the enveloping metal is not employed in too great excess, by passing through it an electric current by which the filament is heated, so that the enveloping metal is volatilized. The metallic particles which remain behind then sinter together into one filament. If another metal is employed as the enveloping metal which itself possesses a very high melting point, this can remain in the finished filaments. Thorium metal, for example, is such an exceedingly easily ductile metal having a very high melting point and one which can be worked up mechanically in this manner.

Brush Arrangement for Acyclic Generator.

A patent was issued on May 4 to Mr. J. E. Noeggerath for means of supporting a collector brush on an acyclic generator so that it may be easily adjusted and firmly held in place and in contact with the collector surface. The brush holders are mounted on a bracket having a T-shaped slide which is movable in a guide on a support inserted in an opening in the frame of the generator. The whole current-collecting device may be inserted radially inward through the opening and readily adjusted when in position. This arrangement is particularly advantageous for acyclic (unipolar) generators, which require a great number of brushes, pressing on collector rings rotating at high speeds, so that they wear rapidly and must be replaced frequently. The inventor states that he prefers to employ collector rings of metal which does not readily volatilize, such as steel, with brushes composed partly of steel and partly of



FIGS. 1 AND 2.—NOEGGERATH ACYCLIC GENERATOR AND DETAILS OF BRUSH-HOLDER.

copper in laminated form. With such an arrangement a very considerable stray flux passes through the collector rings by way of the brushes. The collector rings shift position in this flux as the armature revolves, and consequently eddy currents are produced in the collector rings and the loss occasioned thereby decreases the efficiency of the machine. According to a second patent issued to the same inventor on the above date, the stray flux may be minimized by counter magnetomotive force, while the eddy current losses may be reduced by placing strips of copper on the collector rings for carrying the eddy currents. In order to equalize the wear on the brushes, which is usually greater at the negative brushes of an acyclic generator, the inventor builds those brushes through which current flows to the collector rings with a greater proportion of steel and a smaller proportion of copper than is used with the brushes of opposite polarity.

CURRENT NEWS AND NOTES.

FARMERS DEMAND ELECTRIC LIGHT.—Farmers in the vicinity of Two Rivers, Wis., have made a proposition to build a line to connect with the central-station system of that town in order to be able to use electricity for light and power, and otherwise will build their own generating plant.

EUROPEAN WATER-POWERS.—It is estimated that in 1905 the water-power utilized in several countries of Europe was as follows: Germany, 294,400; France, 650,000; Italy, 464,000; Switzerland, 380,000. Of the total water-power available, Germany utilizes 20 per cent; France, 11 per cent, and Switzerland, 25 per cent. Of power from steam, Germany utilizes 6,000,000 hp, and France, 3,200,000 hp.

CONSUMPTION OF LINE POLES.—According to a recent bulletin issued by the U. S. Department of Agriculture, about 3,500,000 line poles exceeding 20 ft. in length are used by telegraph, telephone and other electrical companies. Three-fifths of these are cedar, and more than one-fourth are chestnut. Relatively small numbers of pine, cypress and redwood poles are used. The steam and electric railways use 153,000,000 cross-ties annually.

UNITED STATES WATER-POWERS.—According to a bulletin issued by the Joint Committee on Conservation the United States has 5,250,000 hp in water-power in use. The undeveloped water-power controlled by the National Government aggregates 1,400,000 hp.

WIRELESS FOR PORTO RICO.—A local Porto Rico wireless telegraph company has been organized subject to control by the Government. The masts and equipment for a 10-kw station have been ordered. There will be at least three stations on the island of Porto Rico and possibly two in the adjoining islands.

HYDRO-ELECTRIC MACHINERY IN PORTUGAL.—It is stated that all of the orders thus far placed for hydraulic and electric machinery for Portugal have been received by Swiss and German manufacturers. The development of water-power is being given considerable attention in Portugal at present and doubtless many additional orders will be placed in the near future.

GAS COMPANIES CUSTOMERS OF CENTRAL STATIONS.—A central station, in some hints to its agents relative tc excellent proofs of the real value of electricity for light and power, gives as satisfied consumers of electricity for light and power in their works a list of almost a score of gas companies that might be known, at least by name, to prospective customers for electrical service.

FORTY-FIVE-THOUSAND-VOLT TRANSMISSION FOR NAPLES.—A concession has been granted to a company for the generation of 16,000 hp at Capo-Volturno, for transmission at 45,000 volts to Naples, 56 miles distant. The city of Naples has secured the rights to another waterfall on the Volturno having a capacity of 4000 hp, and it is proposed to transmit the energy over the same line to Naples.

GOVERNMENT TELEPHONE FOR URUGUAY.—The Uruguayan Government has presented a bill to authorize the sum of $1,500,000 for the construction of a State telephone system. There are already two companies working telephone systems in Uruguay, and the present intention of the Government is to compete with these, and not to acquire them. It is proposed to issue a loan for the amount mentioned, bearing interest at 5 per cent.

A TWENTIETH ANNIVERSARY will be celebrated on July 29 by the Massachusetts Electric Lighting Association, of which Mr. C. L. Edgar, of Boston, is president. The meeting and dinner will be held at the Tedesco Club, Swampscott, Mass. Mr. E. W. Burdett has consented to present "A Twenty-Years' Retrospect" of the association and its membership, including a review of the history and development of the electric-lighting industry during the period.

"ALTERNATING CURRENTS."—There was a large attendance at the meeting of the Electric Club of Chicago on July 21, with Vice-President Vose in the chair. The speaker was Mr. Samuel E. Kiser, who conducts a humorous column in the Chicago *Record-Herald* under the heading "Alternating Currents." Mr. Kiser gave a very enjoyable talk, quoting a number of his quietly humorous poems, and his contribution to the entertainment of the club was much appreciated.

ONTARIO ELECTRIC-POWER SCHEME ATTACKED.—The Governor-General of Ontario is receiving petitions from the electric lighting and other companies asking for a disallowance of the recent Ontario act granting sweeping powers to the Hydroelectric Commission. The local electric-lighting companies claim that the act deprives them of their rights, and it is also claimed that the measure will have a baneful effect upon the credit of Canada in the money markets of the world.

SINGLE-PHASE RAILWAY IN BADEN.—A 10,000-volt, single-phase, 15-cycle railway system is being installed by the Baden Government to connect Basle with Schopfheim and Zell. Electric locomotives will replace the steam locomotives now in use. There will be six locomotives, each of which will be equipped with two 400-hp compensated series motors. The motors will be so mounted as to drive the main wheels through cranks and side rods. The equipment will be supplied by the Siemens-Schuckert Company.

ELECTRIFICATION OF BROOKLYN'S LAST CABLE ROAD.—The better service rendered by the electric trains through the East River tunnel having caused the receipts from the operation of the cable railroad along Montague Street to decrease from $200 to $80 per day, the Brooklyn Rapid Transit Company has decided to equip this road—the last cable line in the city—for electrical operation. An overhead trolley will be used. After the changes have been completed passengers will be carried to the Fulton Street ferry without transferring.

ELECTRICAL MACHINERY FOR KOBE.—A report, dealing with the trade and navigation of the consular district of Kobe states that in the supply of electrical machinery, equipment, etc., there has been active competition between British, American and German manufacturers. Until recently an American firm had practically a monopoly in this district, but latterly British and German firms have secured contracts. With the opening up of electric railways and the extension of various electric light companies it is probable that large quantities of electrical machinery, etc., will be required during the next few years.

STEAM RAILROAD ELECTRIFICATION IN NORWAY.—As is well known, the subject of the electrification of steam railroads have been the subject of study in detail for some years, including tests of the Ward Leonard and several other systems for heavy traction. Owing to the abundance of water-power in that country, it was surmised that the problem was one not difficult of solution. That this has been the case appears from a recent announcement that the details of the electrification of some lines have been completed, waterfalls have been secured by the Government in various districts, and some foreign firms have been invited to submit tenders.

BRITISH BOARD OF TRADE.—The *Revue Electrique*, of Paris, in printing a long description of the laboratory of the British Board of Trade, finds it necessary to explain in footnotes some of the peculiarities of English nomenclature. It is pointed out that the board corresponds to the French Ministry of Commerce; that while the official address is Richmond Terrace, the actual location is 56 Whitehall; and that while the legend on a sign at the entrance is "Board of Trade, Inspecting Officers of Railways, Electrical Department," in point of fact, electric light and power and electric traction are branches under the jurisdiction of other departments of the Government, and the board has officially no electrical department.

ALLEGED TELEPHONE CONSPIRACY.—An action has been brought at Harrisburg, Pa., before the Attorney-General of the State, charging conspiracy between the Bell and Slate Belt Telephone companies, the latter being an independent company. The latter company has served notice on the Consolidated Telephone Companies of Pennsylvania, an independent concern, terminating a long-distance traffic arrangement with the latter. It is charged that the Slate Belt Company in May entered into a secret agreement with the Bell Company under which it contracted to deliver all of its toll business to the latter. The action brought charges of violation of the anti-trust laws of the State of Pennsylvania, in that the making of a connection between the Slate Belt and the Bell tended toward the destruction of competition to the great injury of the public.

Oil-Engine Generating Station at Chichester, England.

IN this country almost every small town has its electric light station, or is at least supplied with electrical energy. Not so in England, where this state of affairs is far from realized and where the additions to existing generating stations are few and far between. An oil-engine station has recently been placed in operation in Chichester, which, because of its size, equipment and nature of the load, is more than of passing interest. The Diesel oil engine has been chosen as a prime mover, and if the Chichester Electric Light & Power Company, which is responsible for the present undertaking, meets with any degree of success, it is not unlikely that many similar plants will be erected in England and many small towns now without a supply of electricity receive the benefits which are inseparably coupled with that form of energy.

Owing to the adoption of the oil engine, the station building is a very simple structure, comprising merely an engine house. This is of red brick, lined inside with white glazed brick. The floor is finished in white and black terazzo and spanned by a five-ton crane. The station is illustrated in Fig. 1, which shows the generating equipment. This consists of two Diesel oil engines designed and constructed by Mirrlees, Bickerton & Day and direct-coupled to two 100-kw, 500-volt, direct-current generators of General Electric make. Provision has been made on the generators for fitting a compound winding should this be required for traction purposes. The engines run at 250 r.p.m. and are started by means of compressed air stored in suitable receivers, and it is stated that an engine can be brought up to speed and fully loaded in the space of two to three minutes.

FIG. 2.—VIEW OF EXTERIOR OF CHICHESTER STATION.

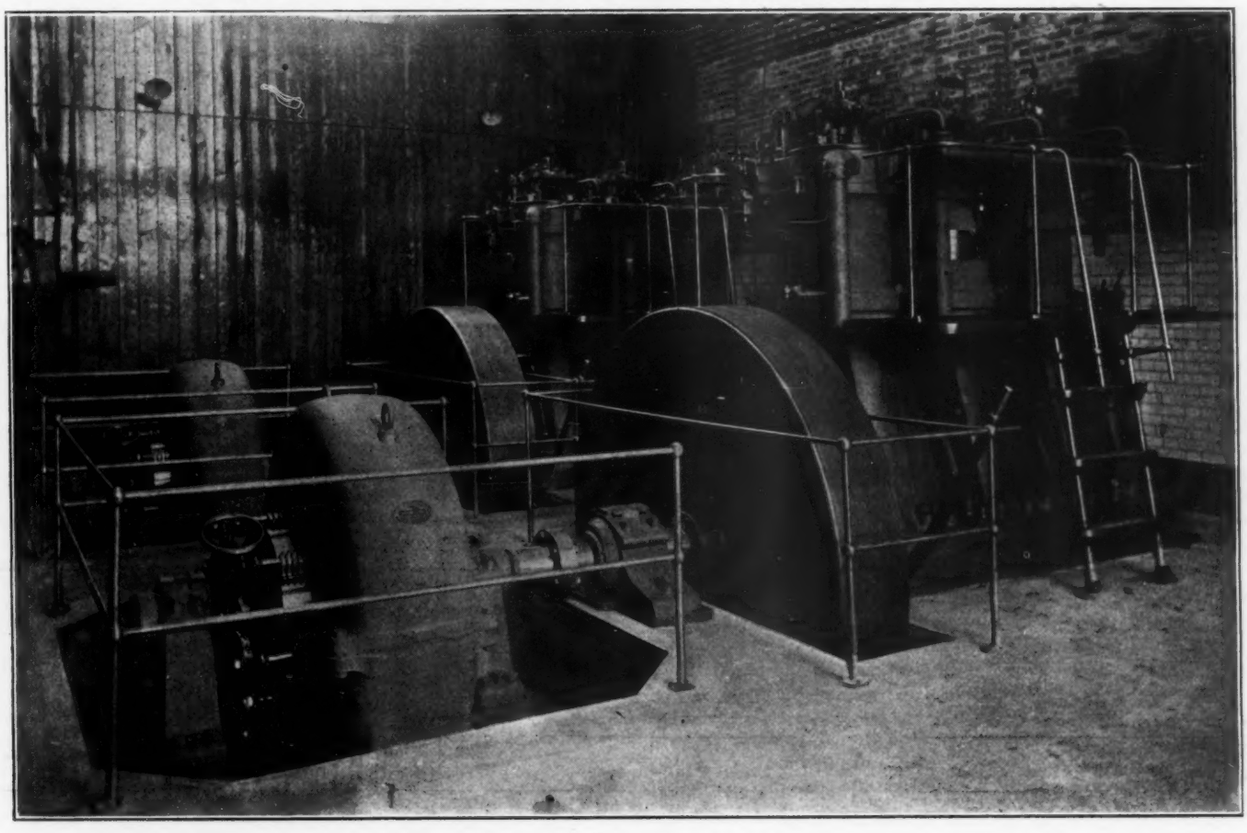


FIG. 1.—ENGINE-ROOM, CHICHESTER STATION.

This is an important feature of oil-engine plants from a central-station viewpoint, particularly where, as in the present instance, storage batteries are not installed, for it is well known that internal combustion engines are not particularly adapted for taking overloads.

Water for keeping the cylinders cool is obtained from a canal adjacent to the works, a circulating pump being driven by spur gear from the engine shaft. About 600 gal. of water per hour are passed through the cylinder jackets when the engines are developing full load, and a visible outlet is provided, so as to cause any interruption of the water supply to be quickly observed. Fuel oil is supplied from a circular tank 6 ft. 9 in. x 12 ft. 4 in. situated near the engine house. The tank holds sufficient oil to allow both engines to be run continuously for a week. It is worth noting that when the oil has been delivered to the storage tank no further handling is necessary, so that the labor required is reduced to a minimum.

As a three-wire system of distribution is employed with 440 volts across the outer wires, a balancer has been installed consisting of two 25-kw, shunt-wound machines coupled on the same bedplate. The switchboard, which is shown in Fig. 3, was built by Johnson & Phillips, and is of standard design for a three-wire system. The board is arranged to control three

generators (one panel being provided for extensions), the panels reading from left to right being feeders, middle wire, balancer, battery, motor, dynamo (extension) and two dynamo panels. It will be observed that provision is made for the installation of a storage battery; but one of the features claimed for the installation is that the oil engines are entirely relied upon for maintaining a supply of electrical energy.

Triple concentric, lead-covered cables are used for feeders

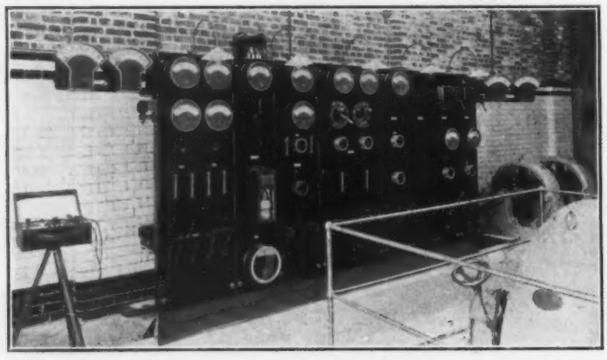


FIG. 3.—SWITCHBOARD, CHICHESTER STATION.

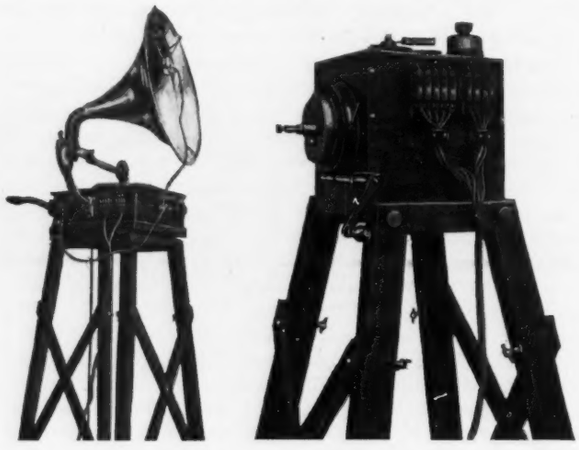
and are drawn into Sykes conduits and three-core cables are used in the distribution network. The latter are armored with steel tape and placed directly in the ground, a board being placed over them to indicate their position when future excavations are made. At present a 0.2 sq. in. feeder cable has been installed and runs to a feeder pillar near the cross, the distributors being fed through fuse switches. For house services concentric-armored cables are used, the service boxes and fuses being of standard type. The prospects of success of the undertaking are said to be very bright and when the supply was commenced over 1200 lamps had been connected. In addition to private lighting, the company hopes to connect quite a motor load, several customers now preparing to install motors.

Three-Phase Device for Driving Phonograph and Moving-Picture Machines.

By Francis M. Weldon.

It has been desired for some time past to secure a device for operating a phonograph together with a moving-picture machine in order to reproduce the image and sounds at the same time. Up to the present, it does not appear that this has been carried out successfully in practice, owing to various difficulties. A solution of the problem seems to have been obtained by Captain Couade, of Paris, who has developed his system at the works of the Pathé Phonograph Company, which is one of the largest in the city and also manufactures moving-picture apparatus.

It would appear that the desired synchronism between the phonograph and the picture machine could readily be obtained by the use of three-phase motors, each instrument having a motor which is connected upon a common circuit. However, for various reasons such a system does not answer the requirements of practice. When working with two such apparatus, the first requirement is to take the records with each instrument, and for this purpose the two apparatus can be coupled together by a connecting shaft so that the phonograph takes the sound record while the picture machine is taking the photographs of the person or persons in question. But for reproduction, the phonograph must be placed near the stage or the point where the screen is located, while the picture machine must be situated at the back part of the hall and is, therefore, at a considerable distance from the phonograph. These two apparatus cannot, therefore, be mechanically connected under such conditions, and an electrical method of connecting must be looked for, using a synchronous system. A brief account of the method which has been adopted in the present case may be of interest. As regards the making of the records in the two apparatus which are mechanically connected together, this is carried out by a person who speaks and makes the appropriate gestures; but as he must speak quite near the phonograph, it is not practicable to make the gestures at the same time. In practice the words are first recorded without the gestures, and then the phonograph is



FIGS. 1 AND 2.—PHONOGRAPH AND MOTOR.

made to repeat the words, music, etc., while the person stands in a convenient position for being photographed by the picture machine. The electrical process does not enter into this part of the work.

In order to reproduce the combined record, it is necessary to drive the phonograph and the picture machine exactly in synchronism, and this is done by an ingenious electrical device. For making the reproduction of the phonograph disk, a weight-driven phonograph is substituted for the electric motor-driven apparatus which was used for taking the record. The mechanism of the phonograph is made to operate at the same time a rotary device in the form of a revolving commutator which receives direct current from a given source and converts this into three-phase current. This latter current is sent into a three-phase motor which is mounted upon a base, usually a folding tripod, and the motor is coupled to the picture machine by means of a universal joint rod. In Fig. 1 will be seen the weight-

FIG. 3.—PHONOGRAPH AND PICTURE MACHINE.

driven phonograph which contains the revolving commutator, and in Fig. 2 the motor, with its regulating apparatus enclosed in a case and designed to be coupled to the picture machine, which is also shown. In this way the phonograph disk and the electric motor of the picture machine are made to work in synchronism.

The rotary commutator is the essential part of the present de-

vice. It is designed to receive direct current at 110 volts from the lighting mains and to convert this into three-phase current so as to operate the synchronous system. The principle which is involved in the rotary device is a somewhat original one, and it will be understood by referring to Fig. 4. A commutator is mounted so as to work in connection with the mechanism of the phonograph. This commutator is provided with a set of

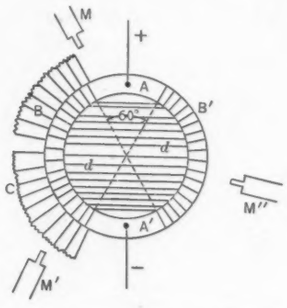


FIG. 4.—DIAGRAM SHOWING PRINCIPLE OF ROTARY DEVICE.

bars, of which there are two bars of large size $A\,A'$, covering 60 deg. of surface. The other bars $B\,B'$ are of smaller size. The commutator is fixed in practice, and the direct-current, 110-volt circuit is connected at $A\,A'$. Between the bars B are mounted the resistance coils C, adjusted to suit the requirements. The bars lying on one side, B', are connected with the set B by means of cross-wires d. Each bar is connected to the corresponding bar on the other side.

Around the fixed commutator there is rotated a set of three brushes M, which are shown here, removed at a distance for the sake of clearness, but in reality they bear upon the surface in the usual way. Captain Couade finds that by properly designing the resisfances between the bars and giving them an increasing and decreasing value, he can produce a current from the three brushes which is practically a three-phase current. The theory of the apparatus involves formulas which are too long to be considered at present, but in practice the current in the circuit of the brushes is very near a sine curve, as will be seen in Fig. 5. The dotted line shows a sine curve, and the full line represents the curve obtained from the apparatus. Such current is quite well adapted for operating a three-phase motor. Instead of using a second set of resistance coils between the brushes B', the latter are connected with the bars B by means of equipotential wires, as shown, and this is found to answer the same purpose.

The three-phase current which is thus obtained has a voltage equal to the direct-current voltage, considering the maximum difference of potential between phases, and the frequency is equal to the number of revolutions per second of the apparatus.

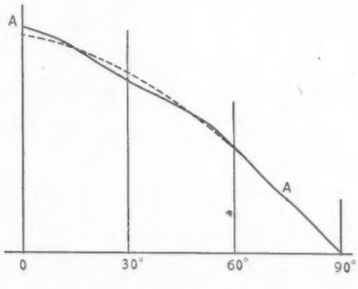


FIG. 5.—CURRENT CURVE.

The resistances are made up of German silver windings in the form of flat coils and are placed beside the commutator, being arranged so as to have a good air cooling. Seeing that the current curve is very nearly sinusoidal, the three-phase motor receiving such current is made to run in a regular manner, and the torque is about a maximum. The commutation takes place with but very little sparking. As to the three-phase motor which is used with the moving-picture machine, it is of a simple kind, being a two-pole motor with shuttle-wound armature. The field is wound like that of a three-phase induction motor, and is connected so as to give two poles. The armature is a soft iron, grooved cylinder which carries an exciting winding. With a larger-sized motor, a simple iron core without any winding can be employed. However, the use of the winding gives a smaller size, and, therefore, a reduced weight to the armature. The speed of the commutator brushes is 360 r.p.m. or six revolutions per second, and this gives a frequency of six cycles. The speed of the three-phase motor is also 6 r.p.m. By the use of a low frequency, the iron in the motor field is reduced to a minimum and the motor is lightened without reducing the torque.

As the voltage of the three-phase motor corresponds at each instant with that of the revolving commutator, it is found that upon starting up the latter the three-phase current gradually rises and reaches its full value in a regular manner. At the start and also at full speed the three-phase motor has sufficient torque for driving the picture machine. As the motor is bipolar, its speed equals the frequency of the current, and therefore the picture machine will start at the same rate as the phonograph and it will arrive at synchronism just as if the two apparatus were mechanically coupled together. This gives the desired coincidence of the phonograph and the picture records. The motor is mounted in a case, which is shown here, and it is small and portable, being mounted on a tripod for convenience. It has power enough to work the machine at the start as well as on regular running.

While the three-phase motor works at 360 r.p.m. it is necessary to rotate the picture machine at one-third this speed, or 120 r.p.m. A gear set for this purpose is mounted on the box, so that by turning the crank on one side the speed of the motor can be increased or decreased while the apparatus is running, and this enables the operator to keep the adjustment in case the two apparatus, phonograph and machine, should accidentally fall out of step, as may happen when the phonograph needle skips over a short distance or where some of the pictures are out of the film.

The Determination of the Current and Voltage Relations in Unsymmetrical Polyphase Systems.

BY CHARLES H. PORTER.

THAT the current and voltage relations in unsymmetrical polyphase systems can be readily determined by the use of complex algebra is a fact less well known than it should be. Some of the text-books take up the special case of an unbalanced load in Y on a three-phase system and show that when the load consists of pure resistance only the voltages and currents can be determined by a method of moments, but none of them gives any method for solving the more difficult cases. This method of moments can probably be developed and generalized, but at best it is in its application to specific problems a method of solution based on mathematically derived formulas the electrical significance of which has been obscured in the process. This may be the reason why it has not come into general use. It is possible that from a purely mathematical standpoint the method to be described below and the method of moments can be shown to be more or less identical, but the application of the present method because of its analogy to familiar direct-current methods is much more obvious.

By the use of simultaneous vector equations exactly analogous to the Kirchoff laws equations for direct-current circuits the most complicated problems can be solved as easily as can the corresponding problems in direct-current work. This statement means simply that the same equations are written as for a direct-current problem with similar data given, but that in the alternating-current problem all of the values must be expressed in complex quantities—that is, in the well-known form, $a + jb$,

for by so doing the time-phase relations of the various quantities are taken care of in the easiest manner.

The method can probably be best brought out by applying it to numerical examples. The notation employed is one based essentially on the use of two subscripts with every symbol or vector representing either current or electromotive force, the subscripts being determined by the lettering of the diagram of

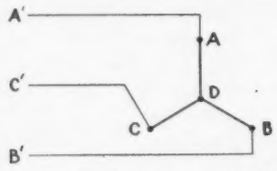


FIG. 1.—CIRCUIT RELATIONS IN THREE-PHASE SYSTEM.

connections. The subscripts indicate that the positive direction of the current is from the first to the second and that the positive direction of the electromotive force is such that the first point is of higher potential than the second. Thus E_{ab} is the electromotive force producing the current I_{ab} in the branch AB and I_{ab} is equal to $-I_{ba}$ or I_{ab} and I_{ba} differ in time-phase by 180 deg. The order of the subscripts therefore is a matter of vital importance.

Consider first the case of three unequal impedances connected in Y between 220-volts, three-phase mains A, B and C. Let the common junction of the impedances be denoted by D and let the three impedances be

$$Z_a = 25 + j\,4$$
$$Z_b = 20 + j\,15$$
$$Z_c = 15 - j\,5$$

If the delta voltages are equal and E_{ab} be assumed as the axis of reference,

$$E_{ab} = +220 + j\,0$$
$$E_{bc} = -110 - j\,190.5$$
$$E_{ca} = -110 + j\,190.5$$

The simultaneous equations for this system are

$$I_{ad} + I_{bd} + I_{cd} = 0$$
$$E_{ad} + E_{do} = E_{ao}$$
$$E_{bd} + E_{do} = E_{bo}$$

These last two equations can be written

$$I_{ad}\,Z_a + I_{do}\,Z_o = E_{ao}$$
$$I_{bd}\,Z_b + I_{do}\,Z_o = E_{bo}$$

from which

$$I_{ad} = \frac{E_{ao}}{Z_a} - I_{do}\,\frac{Z_o}{Z_a} = \frac{E_{ao}}{Z_a} + I_{od}\,\frac{Z_o}{Z_a}$$

and

$$I_{bd} = \frac{E_{bo}}{Z_b} + I_{od}\,\frac{Z_o}{Z_b}$$

Substituting these values of I

$$I_{od}\left(1 + \frac{Z_o}{Z_a} + \frac{Z_o}{Z_b}\right) + \frac{E_{ao}}{Z_a} + \frac{E_{bo}}{Z_b} = 0$$

With the numerical values this becomes

$$I_{od}\left(1 + \frac{15 - j\,5}{25 + j\,4} + \frac{15 - j\,5}{20 + j\,15}\right) = \frac{-110 + j\,190.5}{25 + j\,4} + \frac{+110 + j\,190.5}{20 + j\,15}$$

$$I_{od}\,(1 + 0.544 - j\,0.289 + 0.360 - j\,0.520) = -3.10 + j\,8.12 + 8.10 + j\,3.46$$

$$I_{od}\,(1.914 - j\,0.809) = 5.00 + j\,11.58$$

$$I_{od} = 0.05 + j\,6.07 = 6.07 \text{ in amp}$$

$$E_{od} = I_{od}\,Z_o = +31.1 + j\,90.9$$

$$E_{ad} = E_{ao} + E_{od} = +141.1 - j\,99.6$$

$$E_{bd} = E_{bo} + E_{od} = -78.9 - j\,99.6$$

$$I_{ad} = \frac{E_{ad}}{Z_a} = +4.87 - j\,4.77 = 6.81 \text{ in amp}$$

$$I_{bd} = \frac{E_{bd}}{Z_b} = -4.92 - j\,1.30 = 5.09 \text{ in amp}$$

The voltage between the common junction D of the impedances and the true neutral of the system can now be found. Calling the true neutral O it is evident, since the delta voltages are equal, that

$$E_{ao} = +110 - j\,63.5$$
$$E_{do} = E_{da} + E_{ao} = -141.1 + j\,99.6 + 110 - j\,63.5$$
$$= -31.1 + j\,36.1 = 47.7 \text{ in volts.}$$

The vector diagram, Fig. 2, is plotted with the values computed above. The power in the system if measured by the two-

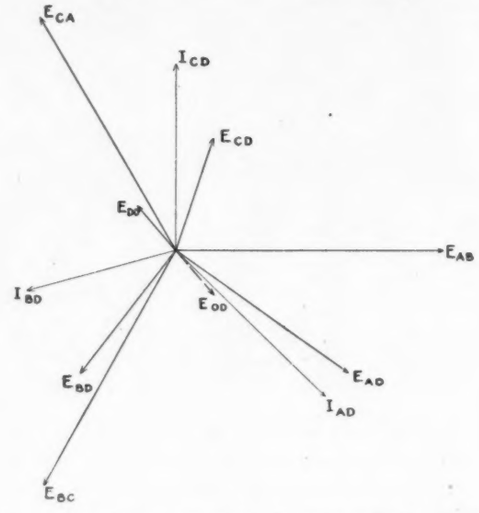


FIG. 2.—TIME-PHASE RELATIONS IN THREE-PHASE SYSTEM.

wattmeter method with the current coils of the instruments in mains A and B would be given by

$$W_a = E_{ac}\,I_{a'a}\cos\Theta_1 = e_1 i_1 + e_1' i_1' = 1446 \text{ in watts}$$
$$W_b = E_{bc}\,I_{b'b}\cos\Theta_2 = e_2 i_2 + e_2' i_2' = 789 \text{ in watts}$$
$$W = W_a + W_b = 2235 \text{ in watts}$$

This total power could have been found equally well as the sum of the I^2r losses for the three impedances.

For any given set of impedances the cyclic order in which they are connected in the three phases makes a difference in the values of the line currents and Y voltages and in the amount of the displacement of their common junction from the true neutral of the system. This fact is frequently overlooked by students.

If in the problem just considered two only of the impedances be interchanged, such as Z_b and Z_c, their cyclic order with

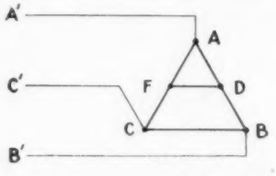


FIG. 3.—CIRCUIT RELATIONS IN INTERCONNECTED SYSTEM.

reference to the impressed voltages will be changed; substituting the new values

$$Z_{a_1} = 25 + j\,4$$
$$Z_{b_1} = 15 - j\,5$$
$$Z_{c_1} = 20 + j\,15$$

in the equations previously derived it will be found that

$$I_{a_1 d_1} = +3.53 - j\,1.60 = 3.88 \text{ in amp}$$
$$I_{b_1 d_1} = -7.00 - j\,4.05 = 8.09 \text{ in amp}$$
$$I_{c_1 d_1} = +3.47 + j\,5.65 = 6.63 \text{ in amp}$$
$$E_{a_1 d_1} = +94.6 - j\,26.0$$
$$E_{b_1 d_1} = -125.4 - j\,26.0$$
$$E_{c_1 d_1} = -15.4 + j\,164.7$$
$$E_{d_1 o} = +15.4 - j\,37.5 = 40.5 \text{ in volts}$$
$$W = W_{a_1} + W_{b_1} = 1542 + 693 = 2235 \text{ in watts.}$$

It will be noticed that the values of the currents are quite different from what they were with the first connection and that the unbalancing of the currents is greater, though the displacement of the common junction with reference to the true neutral is slightly less. The total power taken by the system is unaffected by the order of connection, although its distribution among the different impedances is changed.

If the delta voltages had been unequal the complex expressions for them would have been different numerically, but the form of the equations and the method of solution are, of course, independent of the values used; when the values of the delta voltages are known the complex expressions for them can always be found by the solution of the voltage triangle.

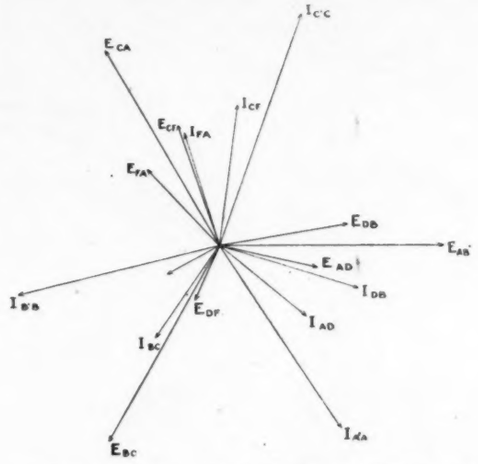


FIG. 4.—TIME-PHASE RELATIONS IN INTERCONNECTED SYSTEM.

Another problem of less practical importance, but which better illustrates the value of this method, is the determination of the current and voltage relations in the following system: Two equal impedances, $Z = 40 + j\,20$, are connected between the mains A and B and the mains A and C of a constant-potential 220-volt, three-phase system. Between the mains B and C is an impedance, $Z = 50 + j\,5$, and a fourth impedance $Z = 20 + j\,15$ is connected between the middle points D and F of the impedances Z_{ab} and Z_{ca}.

If E_{ab} be assumed as axis of reference, the complex expressions for the delta voltages are

$$E_{ab} = +220 + j\,0$$
$$E_{bc} = -110 - j\,190.5$$
$$E_{ca} = -110 + j\,190.5$$

I_{bc} is independent of the rest of the system and its value can be found at once.

$$I_{bc} = \frac{E_{bc}}{Z_{bc}} = -2.56 - j\,3.56.$$

The simultaneous vector equations are

$$E_{ad} + E_{db} = E_{ab}$$
$$E_{af} + E_{fc} = E_{ac}$$
$$E_{af} + E_{fd} = E_{ad}$$
$$I_{af} + I_{cf} = I_{fd}$$
$$I_{da} + I_{db} = I_{fd}$$

The first three equations can be written

$$I_{ad}\,Z_{ad} + I_{db}\,Z_{db} = E_{ab}$$
$$I_{af}\,Z_{af} + I_{fc}\,Z_{fc} = E_{ac}$$
$$I_{af}\,Z_{af} + I_{fd}\,Z_{fd} = I_{ad}\,Z_{ad}$$

Solving these equations for the five currents, the values in amperes are found to be

$$I_{ad} = +3.37 - j\,2.75 = 4.35$$
$$I_{db} = +5.43 - j\,1.66 = 5.67$$
$$I_{af} = +1.32 - j\,4.36 = 4.56$$
$$I_{fc} = -0.74 - j\,5.45 = 5.51$$
$$I_{df} = -2.06 - j\,1.09 = 2.33$$

The voltages are

$$E_{ad} = +94.9 - j\,21.3 = 97.1$$
$$E_{db} = +125.1 + j\,21.3 = 127.0$$
$$E_{af} = +70.1 - j\,74.1 = 102.0$$
$$E_{fc} = +39.9 - j\,116.5 = 123.0$$
$$E_{df} = -24.8 - j\,52.8 = 58.3$$

The line currents are

$$I_{a'a} = I_{ad} + I_{af} = +4.69 - j\,7.11 = 8.52$$
$$I_{b'b} = I_{bd} + I_{bc} = -7.99 - j\,1.90 = 8.21$$
$$I_{c'c} = I_{cb} + I_{cf} = +3.31 + j\,9.01 = 9.60$$

The relation of the various quantities can be better appreciated if plotted as a vector diagram, Fig. 4.

It will be seen that this method bears the same relation to the fundamental equation of alternating currents, $I = \frac{E}{Z}$, where all the values are expressed in complex quantities, that Kirchoff's laws bear to Ohm's law, the fundamental equation of direct currents. If it be remembered that in alternating-current work quantities cannot be considered as known unless they are known as to both magnitude and phase, it is obvious that the method described above can be applied to any problem whatever, however complicated, provided only that the data given are sufficient to make the corresponding problem in direct currents determinate. The application of this method to alternating-current problems is as simple and direct as is the application of Kirchoff's laws to direct-current problems.

Electrical Laboratory Equipment of the College of the City of New York.

BY N. M. SCHOONMAKER.

The College of the City of New York, recently erected at 139th Street and St. Nicholas Terrace, besides being an institution which gives no graduate degrees has further made it an object to keep its work fundamentally practical. Although many students do step directly from it into the graduate courses of universities, the primary aim of this college is to fit young men for the actual work which they will find waiting for them when their college days are over.

When the electrical laboratory was planned, this general aim of the college was followed and the equipment was all designed with the special object of making competent, capable, informed electricians. In the department of physics the students are given a working knowledge of the elements of mechanical and electrical engineering. They are instructed how to design and operate motors, generators, transformers, etc. In the electrical laboratory they become familiar with the simpler types of electrical machinery and learn to operate them.

The Mechanical Arts Building is a three-story structure, 60 ft. x 195 ft. The basement and sub-basement of this building are taken up by the power plant which supplies steam and electric energy to the entire group. Almost all the remainder of the building above the basement floor is devoted to laboratories of the department of physics. The electrical laboratory is located at the south end of the first floor of the building and is approximately 29 ft. x 48 ft. In the main building, in another block, is located a large section of the physics department, where are placed all the arrangements for the minor electrical experiments. The lecture-rooms and laboratories in the main building are provided with both direct- and alternating-current laboratory switchboards, storage batteries cut up into various groups so as to obtain different voltages, and also instruments and rheostats. It is with the main electrical laboratory in the Mechanical Arts Building that this article has to do.

In laying out this laboratory, as well as all the others, an attempt was made to put in as many different types of electrical machinery and appliances as were consistent with the available space and money. This aim renders the system an unusually complicated one. Electricity is generated in the power plant in the basement and sub-basement. The generating equipment

is designed in such a way as to make it possible for students to test it, and in order to familiarize them with different types of appliances, several different kinds of generators were installed. The distribution for lamps and motors for the entire group of buildings is 235-volt, two-wire, direct-current. This voltage was used because so large a percentage of the load is made up of motors, for one reason; and second, in order to decrease the amount of copper in the very long feeder system throughout the group. The alternating current for all the buildings is used only for experimental and electric-furnace equipment and is generated at 250 volts, 60 cycles, three-phase.

There are four 250-kw generators in the main power plant, each driven by a different type of engine—that is, one tandem-compound, one cross-compound, one simple, four-valve and one simple, slide valve. For night use, throughout the whole group, there is a storage battery of 140-amp, eight-hour rate capacity. The switchboard for all these units in the power plant is complicated, yet it is arranged so that students can study it out; but as the principal work is to be done in the laboratory it is here that especial thought has been given to arranging apparatus and circuits for this purpose.

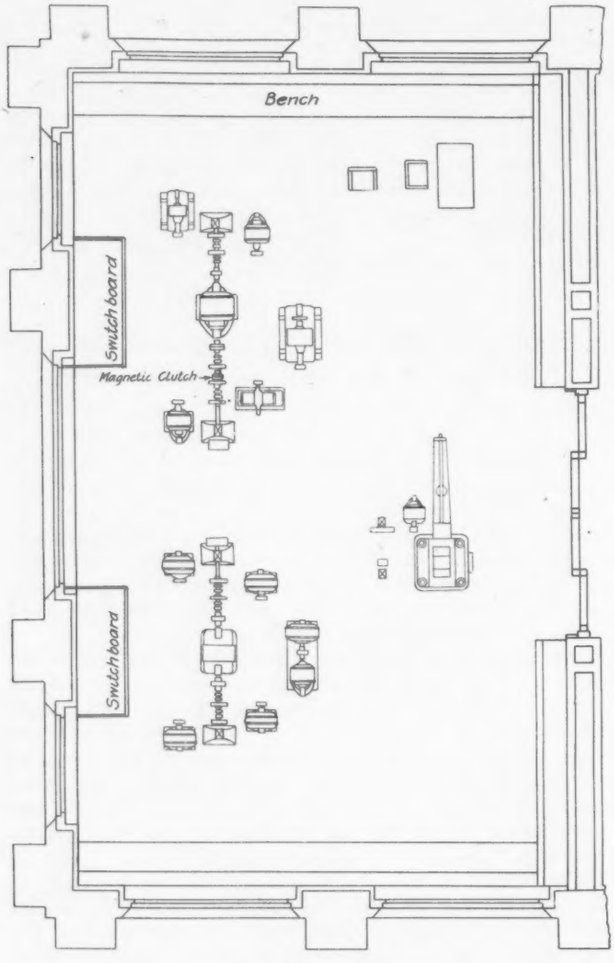


FIG. 1.—ELECTRICAL LABORATORY, COLLEGE CITY OF NEW YORK.

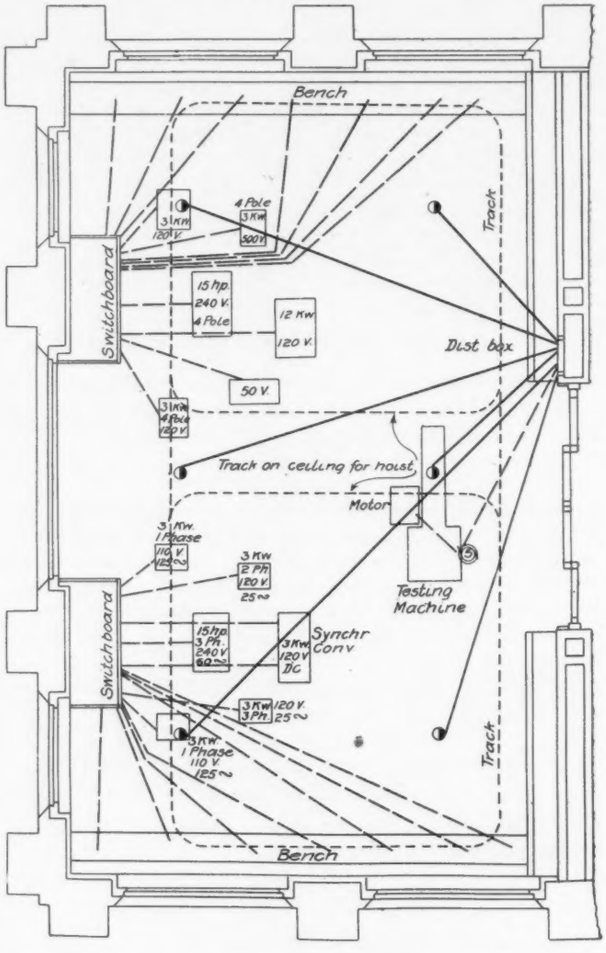

Bench
Switchboard
4 Pole 3 Kw 500 V
3 Kw 120 V
Track
15 hp 240 V 4 Pole
12 Kw 120 V
Dist box
50 V
3 Kw 4 Pole 120 V
Track on ceiling for hoist
Motor
3 Kw 1 Phase 110 V 125 ~
3 Kw 2 Ph 120 V 25 ~
Testing Machine
Switchboard
15 hp 3 Ph 240 V 60 ~
3 Kw 120 V DC
Synchr Conv
3 Kw 120 V 3 Ph 25 ~
3 Kw 1 Phase 110 V 125 ~
Track
Bench

FIG. 2.—CONNECTIONS IN LABORATORY, COLLEGE CITY OF NEW YORK.

The switchboard, motor and generator equipments of the electrical laboratory are divided into two groups; one for direct and one for alternating current. To the buses of the two switchboards direct and alternating current respectively is supplied from the main power plant. There is a motor for each section with an extended shaft from which a number of small generating units are driven, each unit of each section being of a different type. These are all driven by noiseless chain-belts from the motor shaft and are coupled by means of clutches. These clutches are mechanical ones, with the exception of a single electrical one put in to familiarize students with it, and by means of them one or more generators can be used for tests, when the motor is running, without the other generators being called into use. In addition to this arrangement, each motor has a brake pulley on the same shaft, so that a dynamometer test can be run on the motor itself.

The machines of the direct-current group are: One 15-hp, 230-volt motor (the group-driving motor); one 3-kw, four-pole, 120-volt, shunt-wound generator; one 3-kw, bipolar, 120-volt, shunt-wound generator; one 3-kw, four-pole, 500-volt, series-wound generator; one 12-kw, multipolar, 120-volt, compound-wound generator, and one 2-kw, two-pole, 50-volt, shunt-wound generator. Those of the alternating group are: One 15-hp, three-phase, 60-cycle, 250-volt motor (the group-driving motor); two 3-kw, single-phase, 110-volt, 125-cycle generator; one 3-kw, two-phase, 120-volt, 25-cycle generator; one 3-kw, three-phase, 120-volt, 25-cycle generator. In addition to these two groups there is a 3-kw rotary converter, with three-phase, 240-volt, 60-cycle alternator end and 110-volt, direct-current generator, arranged so that either end may be used as generator and the other end as the motor. For detail of this arrangement see Figs. 1 and 2.

The two switchboards are designed as test boards, so constructed and arranged that each of the above machines is a complete power-plant unit in itself. Any two or more of the machines can be used in parallel or in series, and the alternating-current machines may be run in synchronism or out of synchronism. The wiring by which all machines are connected to the switchboards is run in conduit concealed in the floor

construction, and ends in concrete pull-boxes, set in the floor construction, with sides raised above the floor and tops of cast-iron floor plates. These boxes are set immediately behind the switchboards and occupy all the space inside the switchboard inclosures. From the pull-boxes, the wiring is grouped and passes up through conduits to points opposite the switches and instruments on the boards. In order to economize space,

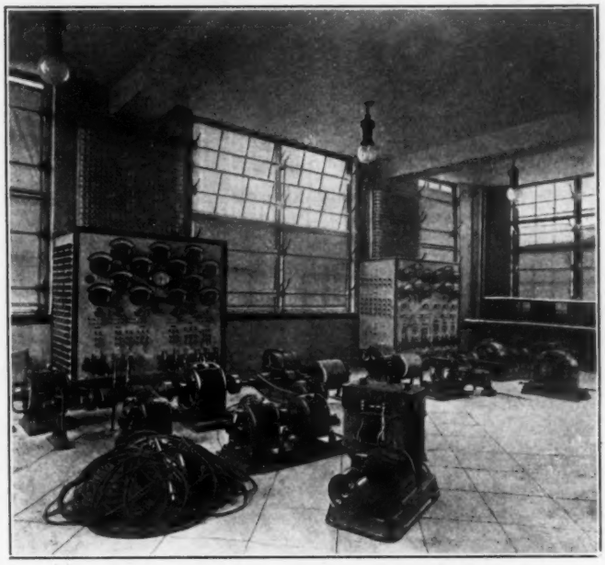


FIG. 3.—VIEW OF ELECTRICAL LABORATORY, SHOWING TESTING BOARD.

both switchboards are built in the form of three sides of a rectangle, with one end of each hinged to provide access to the space behind. These hinged sections are provided with a roller on the pedestal, one on each switchboard, and all connections are made with flexible leads across the hinge ends.

The switchboards are constructed of blue Vermont marble with a polished copper mold extending entirely around each section, and provided with bronze pedestals. On each one of the switchboards is mounted an automatic overload circuit-breaker for each generator, also a main switch, rheostat, illuminated dial, ammeter and voltmeter for each generator. One of the voltmeters on each board is provided with a switch for testing line voltage and grounds on any set of busbars, this voltmeter being marked in ohms as well as volts for the ground tests. On the alternating switchboard there is a synchronizer.

Above each of the two switchboards, mounted on marble slabs against the wall, are banks of lamps for loading the various machines, each bank consisting of 420 16-cp units, some wired in series and some in parallel, so that with 50-volt or

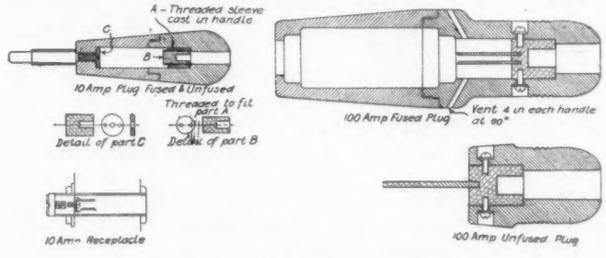

A - Threaded sleeve cast in handle
C
B
10 Amp Plug Fused & Unfused
Threaded to fit part A
Detail of part C
Detail of part B
100 Amp Fused Plug
Vent 4 in each handle at 90°
10 Amp Receptacle
100 Amp Unfused Plug

FIG. 4.—DETAILS OF PLUG SWITCH.

110-volt bulbs a load can be had for any machine. Each switchboard is provided with plug and flexible connections from the various busbars to the various loads, so that any load up to maximum can be plugged into the buses of any machine either by means of the lamp banks or apparatus on the students' benches. The lamps in the banks above each of the switchboards are controlled by 42 rotary switches in the connection between the load buses and the lamps. These switches are of 10-amp rating.

This multitude of busbars and connections on the backs of the boards makes them unusually complicated, and it is necessary to use copper cables painted in various colors to enable the students to trace out the various circuits and connections. The plugging receptacles on the boards are of two sizes,

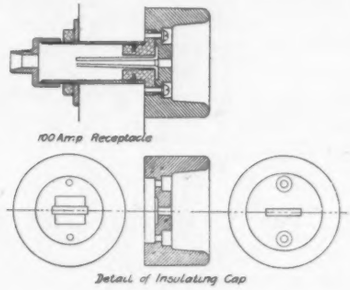


FIG. 5.—DETAIL OF INSULATING CAP.

100 amp and 10 amp resepctively. The 100-amp receptacles are constructed of copper with recessed insulating caps of cast composition, so that short circuits are avoided and the spacing is reduced. (See Fig. 5.) The flexible cables which are used in connection with the switchboards are each constructed with a different type of plug on the ends, one end being fused and the other unfused. The fuses are inserted on account of the liability of students' making improper connections or short circuits, rather than as a protection against ordinary overloads. The ends of these cables are of cast composition, and the fused ends are provided with long sockets to receive an enclosed fuse. Link connectors rated at 100 amp are also provided for bridging from one receptacle to the next nearest. (See Fig. 6.) In addition to the plugs already mentioned, there are 42 permanent connections between the alternating- and direct-current switchboards, each capable of carrying 100 amp, and these are provided with plugs on each board. There are also 10 permanent 100-amp connections with plug-ends extending between the boards and the main switchboard in the Department of Physics in the main building in the next block.

The insulating caps of the plugs on the main switchboard are painted in eight different colors so as to be easily distinguishable, and in addition to this the switchboards are provided with name-plates under each instrument, each switch, and each set of plugs. Students' benches, arranged at opposite ends of the room, one for direct and one for alternating current, are provided with instrument boards on which portable instruments can be mounted and leveled. Each bench is divided into spaces for seven students, and three two-wire, 100-amp circuits run from the switchboards to each student-space. These circuits are provided with receptacles at both ends, those on the benches being somewhat similar to those used on the switchboards.

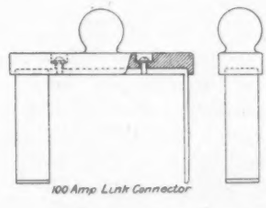


FIG. 6.—DETAIL OF LINK CONNECTOR.

All of the above described plugging provisions make it possible to test any of the machines, either with a lamp load or loads on the students' tables, and either with the switchboard instruments or with instruments located on the students' tables. It also makes possible the testing of motors set on students' benches. In fact, a professor or student may test any one of the machines with loads or instruments in the lecture rooms or

laboratory in the Physics Department of the main building. It will be seen that an almost unlimited number of connections and combinations can be formed. In laying out the plan of the buildings no provision was made in the present group for a testing-room, an omission that necessitated the placing of the testing machine in the electrical laboratory.

As will be seen at once, so extensive and elaborate an arrangement of apparatus required a great amount of thought and care, and for the original design the college is indebted to Mr. C. Howard Parmly, director of the Mechanical Arts Building. Pattison Brothers were the consulting engineers, and the work itself was executed by Hatzel & Buehler, electrical contractors. George B. Post & Sons were architects for the entire group of buildings.

Buying Coal on a Heat-Unit Basis.

Mr. R. T. Gunn, general manager of the Eastern Wisconsin Railway & Light Company, of Fond du Lac, read a paper on the "Purchase of Coal on a Straight-Contract or Heat-Unit Basis" before the Wisconsin Electrical Association at Waupaca, June 29.

He stated that in generating power by steam the cost of coal is about 75 per cent of the entire expense. In most properties the one item of fuel is almost as much as the combined labor payrolls of the entire property. Mr. Gunn, after a year of investigation, feels that it is demonstrated beyond a doubt that the only proper method of making coal purchases is on a heat-unit or pound-Fahrenheit rating. All the larger coal companies, and especially those who handle the best grades of fuel, are only too anxious to sell on a guarantee of so many heat units per pound of coal, and are willing to contract and make settlements on analyses at the end of each month, the purchaser paying a bonus where coal exceeds the guarantee and withholding where the coal does not come up to the guarantee.

To go more into detail, he gives an example of how this may be worked out in practice. In his locality Youghiogheny screenings may be bought on a guarantee of 13,000 pound-Fahrenheit units per pound of coal. To determine what the coal will average and obtain a fair test, a small sample is saved from each day's delivery. These samples are mixed thoroughly and at the end of the month analyzed. Care must be taken to keep samples in air-tight jars. The coal may be wet and the analysis should tell the condition of the coal as actually received and not after it has been air-dried.

Local conditions figure more in buying coal than in any other department of the business. Some may find it economy to buy cheap and low grades of fuel, while others may find economy in the best fuel containing the highest number of heat units per pound, although comparatively much higher in price per ton. Two examples illustrate this. In one power plant which is equipped with B. & W. water-tube boilers, one boiler is sufficient to carry the load 18 hours out of the 24, a second being added over the peak load. With low-grade coal containing a large amount of ash this would be impossible, as furnaces would have to be cleaned during the 18-hour period. This plant, therefore, uses the best coal obtainable. When low-grade coals were used three boilers were required to carry the peak load and two boilers at all times. A saving of $10,000 per annum is now being made in this plant by using the higher-grade fuel. These results have been obtained by making heat-unit tests over a period of several months with different kinds of coal. The same company has another plant equipped with Jones underfeed stokers which, when operating on high-grade coal, shows only a slight saving over the cheaper grades of coal.

The human element is one which must have more consideration if the best results are to be obtained. Firemen can lose or save more money for a public utility than any other laborer connected with the organization. This accounts in a great many instances for the fact that the management does not obtain much better results from high-grade than from inferior coals. Purchasing fuel on a heat-unit basis stops the practice of delivering coal from mines other than that called for in the contract, so that the coal is not uniform. The time will soon arrive when all fuel will be purchased on its real value like any other commodity.

Mr. Gunn also emphasized the economy to be obtained by forcing boilers to their maximum capacity. Part of the saving in the plants he referred to is due to this forcing and not allowing boilers to run underloaded.

Mr. C. N. Duffy said that on June 1 the Milwaukee Electric Railway & Light Company entered into a contract for the purchase of coal on the heat-unit basis as a result of investigations. The company is now obtaining coal of a better average heat value than before and at a lower price.

Some questions were raised by members as to the value of continuous flue-gas recorders or indicators as a guide for firemen. One member thought them too expensive for an ordinary plant. Another thought that recording steam-pressure gages did almost as well, because they led to uniform handling of fires. Mr. Ernest Gonzenbach, however, criticised the idea that a uniform steam pressure meant proper handling of fires. He told of his experience in the management of a North Carolina plant which presented a beautiful steam chart, but where the coal economy was poor. The firemen were in the habit of loading the furnaces as full of coal as they could be piled and sitting down to play the banjo. By a reform in firing methods the monthly coal bill was cut down from $5,000 to $2,200. In regard to the methods of estimating output for figuring coal consumption per kw-hour, he called attention to the fact that some companies take the total kw-hours generated rather than the total kw-hours sent out of the station. Deducting the current used in the station to assist in the production of energy sometimes made considerable difference. In the Sheboygan plant the consumption averages about 5 lb. of coal per kw-hour actually sent out.

Mr. J. R. Cravath, in answer to a question as to the use of the Venturi meter for measuring the water fed to boilers, told of the practice of the Rockford (Ill.) Electric Company, which keeps a Venturi meter with a recording chart in the feed line of the boilers. This records continuously the rate of boiler feed, and the man in charge of the fireroom is not allowed to start an additional boiler in operation until the meter indicates that the rate of water consumption is considerably in excess of the rated load of the boilers in service. This keeps the boilers well loaded at all times. There is more in heavy loading of the boilers than at first appears. When a boiler is being forced, a fireman must of necessity handle his fire so as to get a fair degree of economy from the coal in order to keep up steam, and there is no leeway for the formation of air-holes in the fire.

Mr. R. T. Gunn spoke very favorably of the use of a Williams regulator to keep a constant height of water in the boiler. This prevents water being allowed to get low and other conditions not conducive to economy or safety. Mr. W. B. Voth, chief engineer of the Sheboygan Light, Power & Railway Company, gave an outline of the premium plan which has been in use for four years in the Sheboygan plant with great success. The company inaugurated this plan at a time when it was found that fuel, oil and miscellaneous power-house supplies were costing 1.1 cents per kw-hour. The power-house force is given a premium amounting to 10 per cent of the saving below 1.1 cents per kw-hour. The premium is divided among the men in proportion to their respective salaries. It is really in the nature of a gradual increase of salary, because the larger the output and the better the load factor, the larger the amount available for premium. Mr. Gonzenbach said that he thought it better to pay in this way than by raising salaries. Mr. W. E. Haseltine, of Ripon, reported having used a similar premium plan in the power house successfully. He has a combined water and light plant. The output of the light plant in hp-hours is figured both in electricity and in water pumped. This was determined for each month of the year before the premium plan was begun.

because the relative amounts of electricity and water put out vary from month to month, and the efficiency of pumping is not the same as electric generating. The plan is to give the firemen 20 per cent of the saving in coal per hp-hour by comparison with the same month of the year before the premium plan went into effect.

Electric Energy Directly from the Coal Mine in Colorado.

An electrical transmission system the operation of which is being watched with great interest throughout coal mining regions is that of the Northern Colorado Power Company, whose generating station, between Denver and Boulder, represents the pioneer American installation for the transmission of energy directly from the coal mine. This system, which has been in service since December, 1907, has been increased from time to time, so that it now covers a considerable portion of the best farming district of northeastern Colorado.

In addition to the electrical features, which will be referred to below, the installation operates under conditions which may well be considered unique. The fuel employed is a lignite, possessing 10,800 lb.-Fahr. heat units per pound, which deteriorates rapidly when exposed to the weather. Thus it is unsuited for shipping, but can be used with excellent results at the mine, where it can be purchased at from 75 to 90 cents per ton. The energy obtained from this coal is transmitted, not only for the ordinary village services, but it is used to a large and increasing extent for agricultural purposes, such as driving feed grinders, threshing machines and particularly irrigation pumps. The character of the service is such that during the coming season it is confidently expected that the maximum load will occur during the day at midsummer rather than at night during midwinter.

The generating station, which contains two 2000-hp, 60-cycle, three-phase, 13,000-volt, and two 1000-kw, 25-cycle, single-phase, 11,000-volt Westinghouse-Parsons steam turbo-alternators, is located near the village of Louisville, in the vicinity of which are many of the lignite mines. The station contains transformers for decreasing the 60-cycle e.m.f. from 13,000 to 2400 volts, for distributing energy in the villages of Louisville, Lafayette and Superior, and to 40,000 volts for a 66-mile transmission line for delivering energy to substations located at Longmont, Berthond, Loveland, Fort Collins, Windsor and Greely. Each of these substations is designed for an ultimate equipment of 600-kw in transformers. An additional substation is located at Boulder, to which energy is transmitted over a 10-mile line at the generator e.m.f. of 13,000 volts. This station has been designed for a 1200-kw transformer installation.

The 25-cycle turbo-generators are used for operating the 11,000-volt, single-phase railway which maintains an hourly service between Denver and Boulder, a distance of 28 miles. The rolling stock of this road, which is known as the Denver and Interurban, consists of eight motor cars and four trailers. Each of the former is provided with four 125-hp conductively compensated motors of the Lamme type. These cars operate not only on the 11,000-volt trolley between towns, but they use the 600-volt direct-current trolley in Boulder. In spite of the handicap of the complications incident to the use of both single-phase and direct-current controlling devices, the equipment has proved thoroughly satisfactory.

The local street railways in Boulder and Fort Collins are supplied with direct current from the substations at those points. Through the former substation energy is transmitted over three-phase, 13,000-volt circuits to Salina, and circuits for the same electromotive force are being constructed to Eldorado Springs and Semper. Energy is also delivered from this substation at 2400 volts three-phase to Goldhill. From the Greely substation a 6600-volt, three-phase line extends to Pierce, and a loop line will be erected from this substation to the generating station by way of La Salle, Plattville, Lupton and Brighton. There are in use at the present time about 60 miles of secondary 2400-volt circuits from the various substations used for delivering energy to pumping motors.

For the purpose of providing a storage of water for irrigation and insuring a supply for the steam condenser, a reservoir capable of holding 28,000,000 cu. ft. was formed by constructing a clay dam 30 ft. in height and 2700 ft. long for impounding water over 56 acres near the generating station.

Porcelain insulators held by wrought-iron pins mounted on cedar poles are used on both the 13,000-volt and the 40,000-volt lines. On the former line the spacing of the wires is 26 in., while on the latter it is 48 in.

In the various towns mentioned above there were formerly operated steam-engine driven generating stations for the local service. The service obtained from the transmission system outlined above has proved so satisfactory that the local steam plants have been dismantled.

In view of the very advantageous time-factor of the pumping load it is interesting to note the price obtained by the company for this service. A readiness-to-serve charge of $1 per hp per month is made on each motor installation, and a charge of 3 cents per kw-hour is made for all energy actually consumed. Actual results show that at these rates one acre-foot of water can be elevated 27 ft. for $2.42, which includes 6 per cent interest and 6 per cent maintenance on both the pumps and motors. This price has proved attractive to the farmers and profitable to the company. The rates for lighting are based on a sliding scale, with a maximum of 10 cents per kw-hour, and average about 7.5 cents. For sign and decorative lighting a charge of 5 cents per kw-hour is made.

The president of the Northern Colorado Power Company is Mr. Wm. J. Barker, and the general manager Mr. C. H. Williams. The work of construction was performed by Westinghouse, Church, Kerr & Company. The credit for originating the project noted above is given to Mr. Joseph J. Henry, who was the first vice-president of the Northern Colorado Power Company.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Ohio Question Box.

At the Ohio Electric Light Association, July 13 to 15, during various intervals of the convention as opportunity offered the question box was taken up. The following are some of the questions:

What method should be pursued with consumers having motors when the company wishes to change its service from 125 cycles to 60 cycles?

Mr. W. C. Anderson, of Canton, said that his company made such a change several years ago. The only motors which required changing were fan motors, which involved a relatively small expense. Mr. F. M. Tait, of Dayton, said that in the case of such a change the company should bear the expense. It is unfair to the consumer to require him to buy new apparatus when the advantage of the change is enjoyed mainly by the company. Upon a vote, asked for by the chairman, it appeared that only six stations of those represented are operating 133-cycle service. This, however, does not give an adequate idea of the relative number of plants which still operate at high frequencies, as it is mainly the small plants not represented at conventions which still retain high-efficiency apparatus.

One member asked the question whether there is any benefit in changing from 125 cycles to 60 cycles if there is nothing but

lighting load to be obtained. Mr. F. M. Tait replied that it would be a very peculiar location which would not offer some power business. Assuming that there really was no power business, there would be no advantage in changing to the low frequency.

Another question was as to which is the best combination for a town of 10,000 inhabitants: (a) Three-phase generators and three-phase distribution? (b) Three-phase generators and single-phase distribution? (c) Single-phase generators and single-phase distribution?

Mr. F. M. Tait expressed the opinion that a three-phase generator should by all means be used in a town of this size, the distribution being single-phase or three-phase, as the various local conditions in various parts of the town require. If desired a considerable percentage of the output of a three-phase generator can be obtained from one of the phases, if desired.

Another question was: In stations of 400 kw or less, what method can be used to create interest among the employees in economical operation?

Mr. J. R. Cravath, of Chicago, told of the premium plan in use in some of the Wisconsin plants, most notably the one at Sheboygan, where the power-house force gets a certain percentage of the amount saved per kw-hour below a certain fixed kw-hour cost. Mr. W. C. Anderson, of Canton, said that it is his company's practice to allow a certain amount of coal per kw-hour to give 30 per cent of the saving below this amount to the boiler-room force. Mr. A. A. Pointer, of Antwerp, gives a part of the coal saving to the fireman.

The Commercial Organization of Electric Light Companies and Its Relation to the Public.

Papers on the above subjects were read in the Ohio Electric Light Association convention July 14 by Messrs. W. E. Richards, of Toledo, and C. C. Custer, of Piqua, Ohio.

Mr. Richards said that many of us have come to regard our few solicitors as constituting the entire commercial organization of the company, and perhaps they do. Opportunity and dividends are now often lost by relying upon only 2 or 3 per cent of our forces to promote friendships, sell our products and satisfy our consumers, explain our system, extol our virtues, gloss our faults and preach our doctrines; while the other 98 per cent daily shed their allegiance and their interest when they don their coats and hats, all because we tell them nothing of the company's business outside their own dull daily grind. Numberless chances for substantial benefit and assistance to the company are thus lost. The soliciting and operating forces rarely know the relations of the earnings and expenses to each other. Expenditures or improvements are planned in ignorance of their true desirability, and disgust and disheartenment follow their unexplained curtailment. The clerical force knows little of the difficulties and drudgery of the selling and operating departments. Few of our employees can explain to their friends the company's attitude on the every-day local, commercial or political questions, and can neither justify nor defend it when necessary.

A wider acquaintance with his company's business raises the employee's value and strengthens his influence among others. Every member of the organization unfailingly impresses his personality, ability and character on the composite picture which forms the public opinion regarding the company. Therefore, in reality every member from president to coal-passer is a part of the commercial organization which makes or breaks the company's business. These diverse elements should be brought together frequently for better mutual understanding and instruction. No company is too large or too small to benefit from a policy of broader training for its employees. The best and cheapest commercial organization is a united and interested force of employees who comprehend the general affairs of the concern and the conditions, whether physical, commercial or political which enhance or hinder the prosperity of the business. Communities are not unjust save because of misinformation, and it lies largely in the power of the management to prevent these misapprehensions through the judicious direction and instruction of the employees, who form an active element in the community.

Mr. C. C. Custer in his paper pointed out that large public-utility plants were a necessity to the prosperity and public welfare in any city. The relation between the company and the public should thus be one of mutual benefit. The city must be of sufficient size to offer an attractive field for development. If a town is too small to support a well-built plant, it were better to "hitch your wagon to a star" of greater magnitude by running a transmission line to a larger plant. The public should concede a long-term franchise that the investors may be sure of permanent investment. The generating station, besides being economical so as to furnish service at reasonable rates, should be of neat and modern design so as to be pointed to as one of the city's substantial local industries. It is well that a considerable portion of the stock and bonds of the company be placed locally, in order to strengthen the local standing of the company. While there are some kinds of patronage that will naturally come to the electric light company, there is a much greater amount that is either competitive or needs developing. The company should see that all new buildings that go up are wired for light and power by getting in touch with the owner and architect. The character of load to be most eagerly sought is the daylight or the off-peak load, in order that the load factor or ratio of the average to the peak load may be kept as high as possible. As the only cost factor increased by securing more day load is the fuel bill of the station, it is possible to take on power load on a competitive basis. If a medium-sized town can afford more than one large and efficient power plant the electric generating station becomes a positive power in the community to foster small manufacturing industries. Looking back over a period of 10 years in a town of 15,000 population with natural gas at 25 cents per 1000 cu. ft., he finds an accumulated connected load of 400 hp in motors, a peak load of 800 hp and a total annual income of $4 per capita, but many another plant has put this to shame in certain lines of development. The light and power plant which is most progressive in business-getting methods, and most active in filling and developing its own local field, generally enjoys the most prestige with its patrons and is least harassed by the bugaboo of municipal ownership.

DISCUSSION.

Mr. D. L. Gaskill said that as secretary of the association cases of trouble between Ohio central-station companies and municipalities usually come to his notice, and in 9 out of 10 cases the trouble really started with the company. Wherever a business has no competitor the management is likely to get into a rut.

Mr. F. M. Tait suggested that a convenient way of learning the sentiment in a community regarding the company is to get a stranger to visit a town and talk to various people, who will usually express the true sentiment as they would not to one known to be connected with the company.

Mr. Gaskill said that while this plan was a good one, it was not always feasible in a small town to make a frequent check of this kind, so it was his custom to get some of his friends in the town to perform the same service by reporting to him the sentiment of the community.

Mr. J. C. Martin, of Wilmington, said that a stranger recently investigated the public sentiment in his town regarding his company on behalf of Eastern stockholders. He had found that the most successful way to get new business is to give the service. He had changed his plant from dusk-to-midnight service to all-night service, and then to 24-hour service. One point of interest in connection with his power business which he mentioned was the operation of separate two-phase feeders for power customers. These power feeders are cut out at night, both to stop the core loss on the transformers and to serve as a check on power-users who are under contract not to use power during the hours of the lighting peak.

Care of Electric Automobiles in St. Louis, Mo.

In 1906 there were only 17 electric automobiles in the city of St. Louis. The management of the Union Electric Light & Power Company decided that the only way to foster the electric automobile business and to get a start on a satisfactory basis would be for it to maintain a garage of its own. This was done. A garage was opened on one of the principal streets centrally located with reference to the great western residential district of the city. After starting this garage it was found that it also would be desirable to have agencies for electric automobiles. Consequently the company secured the agency for the Rauch & Lang, Studebaker and Columbia electric vehicles.

A rate was established for the care and maintenance of vehicles. This rate is $30 per month for pleasure vehicles weighing less than 2000 lb. This includes charging, cleaning, renewing of the battery electrolyte and general maintenance. If a customer wishes the vehicle delivered and called for by the garage employees an added charge of $5 per month is made.

As a result of this effort, by the spring of 1909, three years after the garage was started, there were 300 electric vehicles in the city. Of these 74 are being cared for in the company's garage and 52 are being kept regularly at the garage. There are 50 electric trucks operated out of the Anheuser-Busch brewery.

The system of battery maintenance and records at this garage is one of the most complete in the country. There are 64 charg-

FIG. 1.—ELECTRIC AUTOMOBILES.

ing circuits in the garage which start at a central switchboard and terminate in receptacles along the walls and at pillars. Each circuit has a single-pole, double-throw switch. When this double-throw switch is thrown one way it connects its charging circuit directly to the regular charging bus. When it is thrown the other way it is connected to a bus that is supplied through an ammeter. In this way the amount of current in any one of the charging circuits can be instantly determined by throwing the circuit on the ammeter bus.

A log sheet covering half a day's operations is kept at the switchboard and the switchboard attendant must take readings every half-hour of the amperes flowing to each battery and the total voltage of the battery. Batteries are fully discharged twice a week. If the owners do not discharge the batteries on the road they are discharged through a lamp bank in the garage. This artificial discharge is made at the four-hour rate down to a point where the batteries show 1.7 volts per cell when discharging. A voltage reading is taken of all of the cells in each vehicle about twice a month. For this purpose a monthly folder is kept for every vehicle in the house. On the other side of the folder is the name and address of the owner and a line for each day of the month, together with columns in which to enter the time "in" and "out," a. m. and p. m.; whether the battery was watered; whether the vehicle was washed, oiled, controlled, inspected and motor inspected, also odometer reading. The hours charging and maximum temperature of batteries are noted on the daily log sheet. It is, therefore, not necessary to put it on the individual record card. The average life of positive plates is about 18 months; some plates are run 26 months. It is found that the average mileage of vehicles which are in regular service for customers who do a great deal of driving is 45 miles per charge; this is for driving both in the city and the surrounding country.

Vehicles which are not regular "boarders" at the garage, but which are taken care of by the company, are brought in every two weeks. The garage is in alternating-current territory, but is supplied with direct current from a substation in the rear. The garage basement is fixed up for battery repairs and here batteries are taken apart and assembled. Motors which need repairs are taken to the company's motor repair department in another part of the city; meters which need repairing are taken to the company's meter department. Thus the garage is prepared to give the best of attention to every kind of repairing. Transients are charged at the rate of 10 cents per kw-hour with $1 minimum for the care and attention required. Private garages are put on the company's regular power rates, which are too elaborate for repetition here. They were given in the *Electrical World* of March 7, 1908.

The manager of the garage makes it a point to teach all customers carefully the proper handling of vehicles. The customers are educated to watch the indicating instruments on the vehicle and in this way battery abuse and neglect are consider-

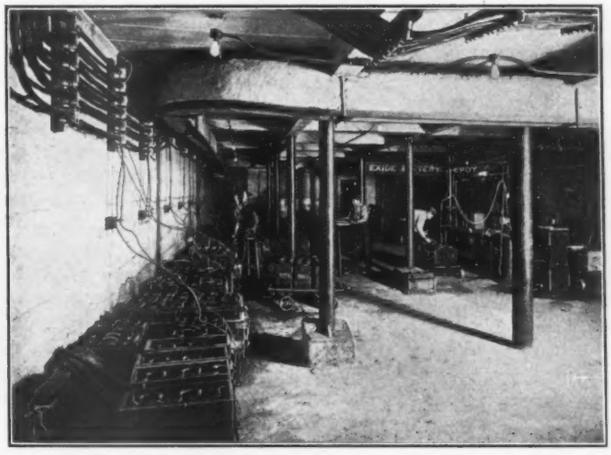


FIG. 2.—CHARGING PLANT.

ably reduced. When an employee from the garage goes to call for a machine he has instructions to examine it carefully before starting to be sure that there is nothing broken. If anything is found defective he must report such defect to the owner at once. This is to avoid any questions as to whether a damaged machine was damaged by the employee sent to bring it to the garage or in some other way. It may happen that the machine was damaged by the owner or that it was run into by some other vehicle while standing in the street before the garage employee called. The automobile department of the company is in charge of Mr. Charles E. Michel, who has built it up to its present state of efficiency.

Factors to Be Considered in Making Street-Lighting Contracts.

Mr. Samuel Rust, in a paper before the Ohio Electric Light Association at Toledo, July 14, gave the following points which should be considered in making a street-lighting contract with a city:

These various factors he groups into length of contract; kind and number of lights; changes in position of lamps; outages; schedule burned; time of payment; cost of service, and manner of contracting.

The length of time that a street-lighting contract should run is a very essential factor to be considered by both parties to the bargain. The statutes of Ohio have fixed the maximum at 10 years. The question is: Should contracts be for any less

period? If the company is a progressive one and keeps abreast of the times in adopting new improvements for its street-lighting service, it should most assuredly not be less, as it can count upon completely changing its street-lighting equipment at least once in every 10 years and this calls for an outlay that shorter-time contracts will not justify. Every street-lighting contract should provide that the company furnishing the lights should have the right to change its system to a newer or better system giving equal or better service during the life of the contract, subject to the approval of the council or board making the contract. Instead of this provision injuring the municipality, the city would profit by getting the benefit of the improvements in electrical service which are appearing so frequently, and it would be an incentive to the company to furnish the city with the best and most up-to-date service.

The proper method of dealing with outages is probably yet to be found. To compel the company to stand the exact price of the lamp when it is extinguished and should be burning is unfair to the company, because of the equipment cost and fixed expenses which always exist; while to excuse the company for continued outage would likewise be unfair to the municipality. A good plan is to agree in the contract just what the outage should be per hour per lamp, and it is suggested that the amount be two-thirds of the price received for the lighting of the lamp.

The kind of lamps to be used in lighting a town or city must depend somewhat upon the size of the municipality. Companies should be careful not to over-light a city in the beginning; as all municipalities grow rapidly and there is a constant increase in the number of lights wanted, the lighting bill may otherwise become too great in comparison to other city expenditures and produce dissatisfaction. While most municipalities do not make any mistake in this regard and are generally under-lighted, there are some that have more lights than the city can well afford to pay for. This is like over-selling a man in goods. He may pay for the goods, but it always results in a dissatisfied customer. In the smaller municipalities it is a question whether the series tungsten will not in time supplant arc lighting entirely. Its economy of consumption and consequently lower price will enable the introduction of a largely increased number and avoid the shadows of foliage which is always dense in the smaller towns.

The number of lights that a municipality can use will determine in some measure the price that should be paid. The price for a street lamp should not be fixed without taking into consideration the fact that the fixed expenses of the plant, sometimes called overhead expenses, will be the same whether 50 or 100 is contracted for.

The schedule that lamps are to be burned must also depend upon the size of the municipality. It is a mistake to furnish all-night and every-night service in towns of less than 5000 inhabitants; for such towns a moonlight schedule is preferable, but every contract should provide that in case the nights are cloudy or stormy, the lights should be burned. Where the town is above 5000 and under 10,000 inhabitants, it is a very good plan to have the contract provide for four nights off in each month, unless they are stormy or cloudy. By doing this the plant is enabled to make repairs to its arc-lighting equipment, without sustaining outages, and plants in cities of this size cannot afford to have so large an equipment as will guarantee continuous service. Cities that are above 10,000 will usually require all-night and every-night service, and usually justify a sufficiently extensive electrical equipment to enable the company to give every-day service on its street-lighting service without inconvenience.

The time at which bills should be paid should always be stated in the contract. It is preferable to make it monthly. To allow bills to grow too large causes the public to murmur at their size.

The manner of contracting in Ohio has been the subject of considerable controversy, but it seems to be the practice to make such contracts without competitive bidding, though a very large proportion of the contracts have been made without such bidding. The revised statutes provide that the Council of any city may authorize a contract with any person, firm or company for lighting the streets, lanes, lands, alleys, squares and public places in the municipal corporation for a period not exceeding 10 years, and the requirement of a certificate that the necessary money is in the treasury shall not apply to such contract.

Many street-lighting contracts are made below actual cost. The following figures are based upon the average cost of a small plant of 100-arc-light capacity, taking into consideration cost of construction, maintenance and operation, and using the standard enclosed-arc system:

It is estimated that each lamp will consume 600 watts per hour, and the time of burning being 4000 hours per year, this gives a total consumption of 2400 kw-hours. Estimating that the average small plant will require 6 lb. of coal per horsepower, the coal consumption for each lamp would be 9.65 tons, which figured at $2.50 per ton in front of the boilers, would be $24.12. The lamp will have to be trimmed about 50 times, and will consume 50 pairs of carbons, costing $2.30. The repairing, time and material would amount to $5; cost of installing about $120 per lamp, and figuring 10 per cent depreciation, would amount to $12 per year. The cost of labor and salaries would aggregate $12 additional, and the interest upon the investment $7.20, or a total cost of $63.62 per year. To show that these figures are certainly low he refers to the report of the commission appointed for St. Louis to investigate the advisability of that city providing its own street-lighting system, in which they found that the cost of operating an arc lamp for a city the size of St. Louis would be approximately near $70 per annum.

DISCUSSION.

Mr. F. M. Tait called attention to the difficulty experienced by nearly every company in making a street-lighting contract from the fact that the prices vary greatly in different cities and a company making a new contract with the city has to make prices to compare favorably with the lowest of those which come under the notice of the City Council without regard to whether the conditions are the same as in the other city under consideration.

Secretary D. L. Gaskill, of Greenville, said that the compilation he had made of prices obtained for street lighting in Ohio had been in great demand not only from Ohio companies, but from all over the world. He is now getting up a new set of figures giving street-lighting rates in Ohio. The situation at New Philadelphia, where the central-station company is trying to renew an old contract of $34 per lamp per year at a higher rate, came in for considerable discussion. This old rate was the result of competition between two companies. Mr. George C. Osborne pointed out that the income per kw-hour received for street lighting varies all the way from 16.6 cents to 3 cents in the State of Ohio.

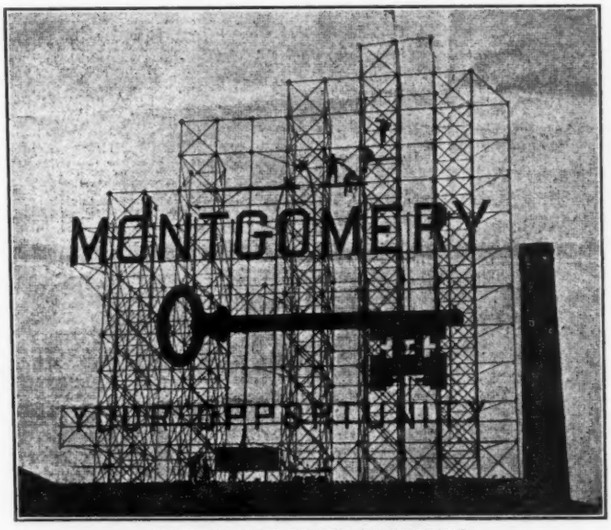
Mr. F. M. Tait thought it policy to make rates for street lighting to the city as low as possible, both to promote good feeling and remove any temptation to start a municipal plant. In reply to a question as to the number of series tungsten street lamps in use in the United States he replied that from the information which the General Electric Company had there were about 150,000 tungsten street series sockets connected. The rates are from $12 to $48 per year.

Mr. Claude Smith, of the Bradford & Gettysburg Electric Light & Power Company (which purchases power from the Greenville Electric Light & Power Company and transmits it to Bradford and Gettysburg, which are towns too small to support profitable individual plants), reported receiving a rate of $48 per year for a 75-watt series tungsten lamp. While this rate may seem high, Mr. Smith explained that in starting service to such small towns it is necessary to have a street-lighting contract at good prices as a basis upon which to obtain money and to justify the building of the transmission line and distribution system. In connection with this rate, it must also be remembered, he said, that a gasoline street lamp giving an average illumination no better than the 60-cp series tungsten actually cost the town $65 per year before the company started service.

INTERIOR WIRING AND ILLUMINATION

Electric Light Company Presents Monster Sign to Montgomery, Ala.

The accompanying illustration shows the sign presented by the Montgomery Light & Water Company to the city of Montgomery, Ala. The picture was taken just before the sign was completed, and shows the men at work in the framework which holds the letters. The sign, which is lighted by some 2600 lamps, was the outcome of an idea of Mr. George Williams, connected with the Doherty interests. It is 85 ft. long and 75 ft. high. The slogan adopted is the outcome of a contest opened to all citizens of Montgomery, the key being the idea of a woman, and the wording, of a local newspaper reporter. In



ELECTRIC SIGN BEFORE COMPLETION.

addition to the words and key shown there is a sky-rocket effect added and the sequence of operation is as follows: A single line of lights comes up like a skyrocket, and at the crest of its long curve breaks into a shower which plays about the key studded with red lamps. Then "Montgomery" in white appears followed by the lower line "your opportunity." The key remains lighted all the while, and the upper and lower lines are flashed on and off alternately. It is said that many hundred thousand persons pass through Montgomery, Ala., yearly, who do not know the name of the place, so that the sign should serve as a good advertisement for the city. The upper row of letters is 10 ft. high and the lower row 6 ft. The sign is erected on the roof of a factory in North Montgomery.

Printing and Illumination.

Within the past year there has been considerable discussion in the technical press regarding the kind of printing which is best from the standpoint of the illuminating engineer. A suggestion has several times been made of late that light letters on a dark background would be far preferable to the method now employed, on the ground chiefly that white letters on a dark ground could be read with less unnecessary stimulation of the eye than dark letters on a light ground. It is an interesting suggestion, although far from a novel one. To the best of our remembrance it has cropped out off and on for the last 30 or 40 years and the earliest suggestions probably go back much further even than this. Since the general use of electric and other brilliant lights, modified forms of printing have a larger significance than before on account of the undoubted over-stimulation that comes at times from working with too brilliant illumination. Save for occasional exhibits of an illustrative nature, very little has been done in a practical way, so that data based on actual use are conspicuous from their absence in the discussion of the problem. To go into the history of the matter, some 35 or 40 years ago the blue-glass cure was a popular fad. Some of our readers have possibly seen windows glazed with alternating panes of clear and of cobalt-blue glass still remaining as the relics of a panacea which in its day had as many alleged cures to its credit as the psychotherapy of later years. If we remember aright, some of the literature circulated by the originator of the blue-glass cure was in white ink on blue paper and later in blue ink on white paper. So far as we know this is the first reduction to practice of the suggestions now under discussion. The dark background in this case was chosen, not with any scientific view of improving contrasts, but merely for the supposed hygienic value of blue radiation.

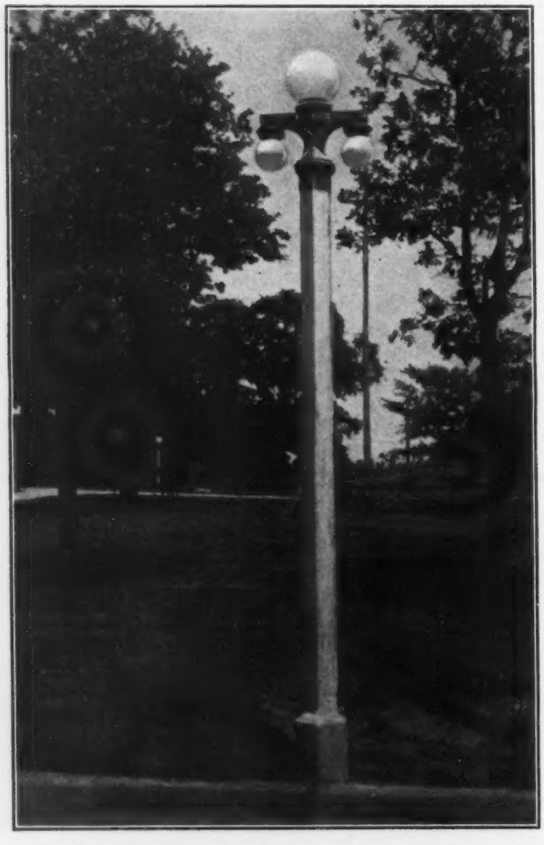
As regards general facts in the case, it is undeniable that much printing as at present done is exceedingly bad for the eyes. The early printers, using a dead black ink on hand-made matt surface paper, frequently not bleached to a brilliant pure white, certainly obtained results in legibility that have never been surpassed and seldom have been equaled since. In fact, the first printed book—the "Mazarin Bible," dating from 1455—has never since been equaled as an example of the printing art. As time has gone on, chemical bleaching processes have been applied in the manufacture of paper, while the half-tone cut, requiring an extremely smooth surface for its successful reproduction, and cheap quick-drying inks, have come into extensive use, with the result of greatly decreased legibility under ordinary conditions of light. But the fault with modern printing lies not in the use of black letters on white paper, but from the fact that the white paper has generally so smooth a surface that it produces a very strong element of specular reflection, giving a glitter that is altogether distressing. Much of the ink used, too, has a brilliant surface as if varnished, so that it too possesses a considerable power of specular reflection, with the result that the combination inflicts upon the eye an amount of light that is certainly harmful. To these peculiarities rather than anything else is due the complaint of unhygienic properties in modern illuminants. Under these common conditions of printing a change to white letters on a black ground will probably do harm rather than good. It is nearly impossible in printing to produce considerable areas of uniform black, and even a paper colored black or some very dark tint in the web would be far from having a uniform matt surface. If an opaque white ink suitable for printing on such paper could be produced, it would still leave an unsatisfactory background and would probably have, like the present black inks, a surface permitting considerable specular reflection. Moreover, the fact that the white letters would have less area, permitting brilliant reflection, than the background of the printing now has, is not significant. It is not the area that produces trouble, but the over-stimulation of any part of the area. The mischief is done by the too intense light and is great in proportion to the intensity. One could get, therefore, quite as serious results from over-illuminated white letters as from over-illuminated background, inasmuch as the damage to the eye is chiefly done, not by pure exhaustion of the retina, but as the result of the inflammation produced.

The remedy for existing conditions apparently lies in the reduction of extreme contrasts by the simplest possible means, and especially in the use of matt-surfaced papers and dead black inks for all printing designed for close application. Some of the very worst examples are to be found in text-books in which highly calendered paper is employed to facilitate the use of half-tone cuts. All printers are sinners alike in this matter and they probably will continue to sin so long as a good and durable matt surface paper remains high in cost. The cry is for cheap books, which implies the use of cheap paper and cheap inks. When the public is willing to pay a small additional price for well-made and durable books of permanent value, reform will be easy. An elimination of the extreme

contrasts between background and printing is the vital point in any such reform, and this can readily be secured by using a matt-surfaced cream-colored paper and high-grade inks, using line cuts where illustrations are necessary, except in the case of inserted plates. Slightly larger type than is customarily used in books which have to be comparatively cheap will still further increase legibility. The one vital question is not the use of black letters on a white ground against white letters on a dark ground, but the reduction of contrasts and the elimination of specular reflection. An excellent example of the very bad results which have been produced by white letters on a dark ground may be found in the ordinary school blackboard. In fact, some well-informed oculists have advanced the opinion that conditions would be greatly improved by using a light background and a dark crayon on account particularly of lessened trouble from specular reflection. Even the most careful writing on blackboards is from certain angles of view almost illegible, and anyone familiar with school conditions realizes the trouble which is practically produced in this way. One would hear of relatively few complaints about the trying effect of modern illuminants if people kept the direct light out of their eyes, and carefully avoided direct surface reflection.

Park Lighting at Oklahoma City.

Recently the Oklahoma Gas & Electric Company presented to Oklahoma City the equipment for lighting Stiles Park, one of several small circle parks at intersections of streets with the new 26-mile boulevard. The equipment consisted of eight concrete posts, four carrying three globes and four carrying single globes. The posts are of reinforced concrete, hollow



THREE-GLOBE CONCRETE POST AT STILES PARK.

and hexagonal in design, manufactured by the Hollow Concrete Pole Company. They are surmounted by ornamental copper caps which carry the lights.

The lighting of the three-globe posts consists of one upright 100-watt tungsten, and two 60-watt tungstens suspended from 12-in. arms. The single globe posts are lighted with 100-watt tungstens. This lighting supplants one enclosed arc formerly hung from a 60-ft. pole in the center of the park. The popularity of the park has greatly increased since the installation, the present use being more than double the former attendance. The residents of McKinley Avenue have petitioned the council to install 100-watt tungstens on 57 concrete poles now carrying the company's lines along that thoroughfare.

New Telephone Patents.

COIN COLLECTOR.

Pay-station coin collectors are of many different types. In some collectors the coin taps a bell, in others a lever must be pulled. Still others require the deposit of a coin to complete the electrical circuits. Some collectors of the prepayment type are made for returning a coin if the connection for any reason is not carried through. Heretofore the operator has had one key to depress to deposit a coin and another to return a coin to the subscriber. To simplify this operation is the object of an invention of Mr. S. J. Larned, of Chicago, Ill., the patent for which is assigned to the Western Electric Company. In his system the circuits may be so arranged that in case a connection fails, the patron manipulates the return of his coin.

PARTY-LINE LOCK-OUT SYSTEM.

Messrs. H. J. Roberts, of Evanston, Ill., and C. A. Soans and A. H. Graves, both of Chicago, have jointly patented a party-line lock-out system. The system is arranged so that harmonic ringing may be used, and the application of the proper current not only effects a call, but operates the lock-out devices.

The system is upon the bridging basis and the stations are not interdependent. An emergency signal is provided so that one locked out may signal central of this condition.

All circuits are metallic, and the system is adapted to complete common-battery working. The patent is assigned to the Homer Roberts Telephone Company.

Letters to the Editors.

Effect of Seasons on Wireless Transmission.

To the Editors of Electrical World:

Sirs:—While the difference between the range of a wireless station in day and in night has been more or less satisfactorily explained, little seems to be known about the reason for the enormous difference between the carrying power of a station at night in summer and in winter. I submit the following notes, made during the past year, while I was employed as wireless operator on a steamer running to South America, in the hope that they may lead to discussion or investigation which will clear the matter up:

About Oct. 1, 1908, long-distance signals—that is, coming from stations more than 300 miles away—began to be noticed in the evenings about 8 o'clock, but would be too weak to be readable until about 9:30, when, within a space of about 15 minutes, they would increase to about three times their original strength and remain so until daylight. This continued during October, the time at which the signals would become strong, getting gradually earlier, until by the middle of November the time at which they would be readable was about 8 p. m. The greatest distance recorded up to this time was 700 miles. As the winter approached the suddenness of the increase in strength gradually disappeared and signals were heard earlier and earlier until in about the middle of December, distant signals could be heard even before it was quite dark and, a little later in the evening, stations in some cases 1500 miles away could be heard as strongly as a station 100 miles away in the daytime. From the middle of December until the first part of April I was in communication with our stations up to distances of 1200

miles, the communications being reasonably reliable, although at times much trouble was experienced from interference from other stations. The instruments used were a 1-kw set, designed for communication for 200 miles.

As the spring approached the time at which it was possible to work long distances became later and later, and I first noticed the difference which the wave-length made. By the middle of May, short waves—that is, waves shorter than about 800 m, would not be noted until about midnight and then not for distances of more than 500 miles, while longer waves did not seem to be affected at all. Moreover, anywhere south of the latitude 30 deg. N. a heavy "static" discharge, an almost continuous roar, would start about 8 p. m. and continue until daylight. About this time, also, the strength of signals from all short-wave stations would change enormously and very quickly, the change affecting different stations at different times. In 10 seconds the strength of a station's signals would change from strong to nothing, and as quickly back again, making satisfactory communication with a station out of ordinary daytime radius an impossibility.

By the first of June the long-wave stations began to be affected, but not nearly as much as the short-wave stations, and as late as June 10 I heard the South Wellsfleet station, 1200 miles away, although it was impossible to read his messages on account of the "static."

At the present time the distance over which it is possible to transmit from a short-wave station is usually even less at night than in the daytime, as the "static" is worse at night, while the signals seem not to be appreciably stronger. This is particularly the case in the tropics, where, at this time of the year, it is almost impossible for a ship to telegraph over more than 100 miles at night.

Aside from this gradual change there is another change which is noticeable at any time in signals from stations much more than 200 miles away, but is particularly noticeable in the winter. A station's signals will be received strongly and steadily for several hours and then suddenly they will fade away in five seconds or less, and will not be heard again for perhaps an hour. In some cases the change is due to defective insulation at the sending station, but in the greater number of instances it must be due to some change in the absorptive power of the atmosphere between the two stations.

I have been unable to determine any relation between the strength of long-distance signals and local weather conditions. On some nights the signals would be good, while on others they would be poor; but while there might be a 50-mile gale on one good night, the next good one would be clear and calm, with not a cloud in sight, etc. I had no way of measuring either the exact strength or the wave length of the signals, so that my estimates are only approximate. I hope, however, that this letter may be the means of throwing some light on the subject.

ATLANTIC CITY, N. J. AUSTEN M. CURTIS.

Value of Classics in Engineering Education.

To the Editors of Electrical World:

SIRS:—A subject so large as that touched upon in Dr. Steinmetz's Frontenac A. I. E. E. paper—the utility of the classics in engineering—requires, it would seem, to be considered from a number of different standpoints in order to arrive at a proper judgment. The time expended in the study of the classics, the benefits obtained from the time so expended as compared with other studies, and many other questions call for consideration. It is coming clearly to be recognized, however, that it is out of the question for the average boy to study classics, unless in a very superficial way, owing to the pressure of necessity in other directions of study, and of the little time that can be spared in school years for such work. The only remaining question is that affecting classics in the school curriculum of the 1 per cent, or less, of boys who have both the money and the inclination for a college career.

One specific value of classical education peculiar to America is, however, the value incident to a long, steadily maintained, inflexible intellectual discipline, which is particularly needed for the youth of the North American race. Owing to the barrier of the Atlantic Ocean—in early days much greater than at present—the emigrants who elected to pass that barrier were necessarily more enterprising and more restless than those who stayed behind in Europe. By necessity an artificial selection of stock was set up, the accumulated products of which have been retained in this country by inheritance. We have, therefore, in North America a stock that is markedly more enterprising and restless than that of its European parentage. These qualities are good, but they also involve defects. Among such defects appear to be instability of purpose and changeability of design. This tendency should be combated in youth by rigorous discipline, gradually relaxed as adult life approaches. The present educational system of this country lacks the rigor and discipline that are particularly important for the people that have come to inherit the land. In time it is to be hoped that these defects will be realized and minimized. Meanwhile, the rigid intellectual discipline of a classical education should have special vaue in America.

CHICAGO, ILL. J. K. HERMANN.

To the Editors of Electrical World:

SIRS:—The study of the so-called "classics" by an engineering student seems to the writer a sinful waste of time. We are to judge the propriety of a course of study by the reasons advanced for its pursuit; those given by the advocates of dead languages are wholly unconvincing. Dr. Steinmetz's dismissal of the equivalency of the study of modern languages with a rather slighting allusion by no means disposes of them; he should, I think, point out in what particulars there is an essential difference in the study of any two languages as a means of mental discipline. Really to know any language having an extensive literature is a work of a lifetime, though I grant freely enough that the veneer of acquaintance given by a course such as is prescribed in most schools is not to be considered. But just why is not a critical and minute acquaintance with Dr. Steinmetz's vernacular or the French not a work of culture of the same class and difficulty as the translation of Virgil and Horace, at least as they are rendered by the average student?

I feel sure that the most enthusiastic exponent of Latin and Greek will admit that they are quite useless so far as the information which is only to be obtained in those languages is concerned. From Cæsar to Tertullian it has all been done, as the old translators say, into all the tongues of the globe.

The fact is, the study of languages involves only memory, and has no relation to the cultivation of the reasoning powers; it is a fetich, nothing more. In ancient times, when knowledge (especially in the sciences) was recorded in Latin, so as to be available on equal terms to workers in all countries, it was natural enough to preface the real study by drilling the pupil in the vehicle of instruction, but to suppose that it was so done because of any "cultural" effect is to put the cart before the horse. It was thus arranged for exactly the same reasons that move an American student to study German before matriculating at Leipzig or Berlin.

Of course, a knowledge of root-forms is often useful, in any language; but it is acquired at too great cost by giving up hours to the study of the orthoepist. In the end, we must give up something; we people of ordinary abilities cannot, like Herbert Spencer, take all knowledge for our province; we shall not succeed as well as he—even!

For 12 years I spent an hour or more every day reading Latin under a competent master; my regret is that the time was not passed in mastering a modern tongue, colloquially and accurately. I have never gone hungry for lack of Latin; I have for lack of Spanish. If we want pure culture, study quaternions; they have "no base utilitarian purpose."

NEW YORK. THOMAS J. JOHNSTON.

Why Not Advertise the Telegraph?

To the Editors of Electrical World:

Sirs:—A Chicago daily newspaper recently called attention to the fact that while electric light and telephone companies, steam-railroad and electric-railway companies direct attention to the service they perform by advertising through various mediums of publicity, the telegraph companies do practically nothing of the kind. This policy is criticised as unwise and old-fashioned and as accounting in large measure for the prevailing idea of the backwardness of the telegraph service in this country compared with other public utilities.

It would seem that the telegraph business of the country could be greatly increased—perhaps doubled or trebled—by judicious advertising, particularly coupled with a reduction in rates for which the increased business would give ample warrant. But this course has never been followed by the great telegraph companies, and it is a matter of curious interest that this is the case. So far as the rates are concerned, they have been increased rather than diminished in recent years, whereas in almost every other line of public service the tendency is in exactly the opposite direction.

What is to prevent the creation of new business for the telegraph companies by well-planned campaigns of publicity? In England the telegraph is much more familiar to the great mass of the people and used to a much greater extent, proportionally, than in the United States. This is not because the telegraph is controlled by the Government in Great Britain and not in this country, but rather because the rates are low and the service reasonably good. Of course, the distances are very much greater in the United States; but nevertheless it is true that the great body of the American people, including the business community, regard the telegraph as something apart, to be used only in case of emergency. It seems to be apparent that there are latent possibilities in the business which have not been fully realized either by those in charge of it or by those who patronize it. Telegrams receive more prompt attention than letters, and, to mention one instance, it would seem that a greatly extended use of the service could be made by business houses in large cities in keeping in touch with country customers, often saving the expense of a visit from a traveling salesman.

Judging by the experience of other electrical utilities, it would seem to be high time for the telegraph companies to realize the merits of advertising and tell the people why they should make a more every-day use of their service. This policy, coupled with a judicious reduction in rates, ought to work wonders in popularizing the use of the telegraph. Should the present *laissez faire* policy of the telegraph companies continue there is little doubt that the Government ownership of telegraphs will some day become a live national issue, and, moreover, will have at least the passive sympathy of large bodies of men not personally in favor of the principle of Government ownership.

Chicago, Ill. Chas. L. Thompson.

The Hysteresis Equation.

To the Editors of Electrical World:

Sirs:—In an article on "Power Characteristics of the Tungsten Lamp," printed in your issue for July 8, 1909, Dr. Steinmetz says:

"This law of hysteresis ($w = \eta B^{1.6}$) is still an empirical law, and all attempts to derive it rationally from theoretical considerations have thus far failed."

In response to this I beg to say that through an analysis of the magnetic loop I have derived rationally from theoretical considerations a formula for the computation of the hysteresis loss. It reads:

$$w = \frac{2}{\pi^2} \times 10^{-3} \times \eta_0 \times M^2_{max}$$

where

$$M = B \text{ — field strength}$$

and

$$\eta_0 = \frac{\pi}{2\, M_{max}} \times \int_o^{M_h} \left\{ \eta_1 \cos \frac{\pi}{2} \frac{M}{M_{max}} + 2\eta_2 \cos 2 \frac{\pi}{2} \frac{M}{M_{max}} + 3\eta_3 \cos 3 \frac{\pi}{2} \frac{M}{M_{max}} + \ldots\ldots\ldots \right\} dM$$

M_h = limit value of magnetic cycle.

That the formula thus obtained is correct is clear from numerical relations as well as from the dimensional test—c.g.s. system. Dr. Steinmetz's formula will not stand the latter test. The law of the 1.6 power seems to be incidental, in so far as a relation seems to exist, between the function to be integrated and the limit M_h of integration.

New York, N. Y. Hans Lippelt.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Compounded Alternator.—An illustrated description of the Parsons compounded alternator in which the method of Stoney and Law is used. The principle made use of is that while an alternating current cannot directly produce a unidirectional magnetic field, it can be made to diminish such a field. If an

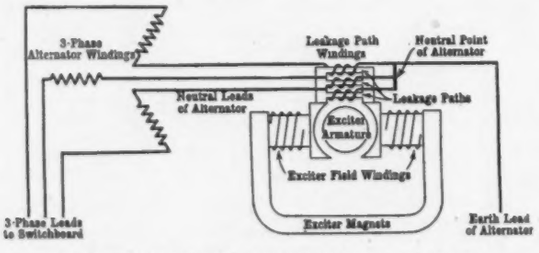


FIG. 1.—COMPOUNDED THREE-PHASE ALTERNATOR.

iron core or "leakage path" of suitable cross-section be laid across the pole pieces of a dynamo and the magnets be powerfully excited, lines of force will be diverted from passing through the armature, and the iron of the leakage path will be saturated. Now, if the core carries a winding through which alternating current is passing, it will be seen that when the current is passing in one direction, it cannot appreciably increase the "leakage flux" through the core, owing to this being already saturated; but when it reverses and flows in the other direction, it will reduce the leakage flux. Fig. 1 shows the arrangement for a three-phase alternator. The "leakage paths," which are of laminated iron, are seen bridging the magnets of the exciter; when load comes on the alternator the leakage flux is choked back and the flux through the exciter armature is increased, thereby raising the voltage of the excitation of the alternator. The action is practically instantaneous, since the load current of the alternator is used directly to effect the regulation, without the intervention of any mechanical apparatus, the action being wholly magnetic. The leakage path windings are placed between the windings of the alternator and its neutral point, which is usually either "earthed," or at a potential differing but little from earth, but in spite of this they are insulated for the full working voltage of the alternator. In a few special cases use is made of series transformers instead of passing the main current round the leakage paths. Fig. 2 shows the characteristic curves of a 1000-kw alternator with and without the leakage-path compounding. The curve marked *A* shows the effect on the voltage when a very inductive load is thrown on; by the time the full-load current of 220 amp is reached the volts have fallen to 2300, so that the load on the

plant is really only 700 kw. The curve marked *B* shows that when the compounding is in use, the voltage remains practically constant, or if required, a slight increase in voltage can be arranged to compensate for pressure drop in feeders. The curve marked *C* shows the effect when full inductive load is removed, without the compounding arrangement. A further

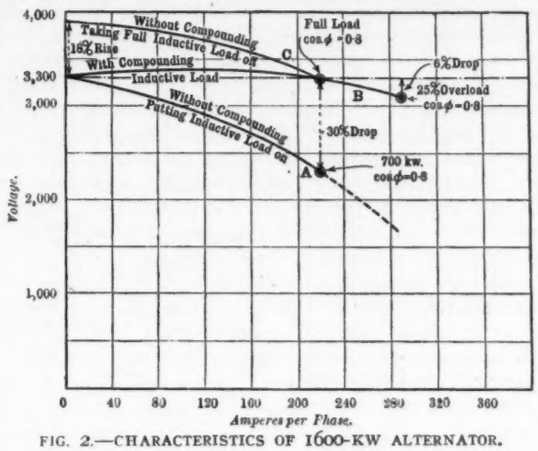


FIG. 2.—CHARACTERISTICS OF 1600-KW ALTERNATOR.

advantage of the system of voltage regulation is that the alternator may be designed for a much smaller short-circuit current. —Lond. *Electrician*, July 2.

Commutation in Direct-Current Generators.—W. E. HIGHFIELD AND R. LIVINGSTONE.—While the reactance voltage is usually regarded as an excellent criterion of the commutating properties, the permissible value of the reactance e.m.f. changes with the size of the machine, from 3 volts in 100-kw, 600-r.p.m. machines to 7.5 volts in 1500-kw, 160-r.p.m. machines. The principal reason for the variation of permissible reactance voltage is the reduction, or increase, of the reactance voltage due to the variation of the number of lines of the main field enclosed by the short-circuited coil. In most cases the cutting of the main field will reduce the reactance voltage, and this corrected reactance can be regarded as a safer criterion of the commutating properties of the machine than reactance voltage alone. The calculation of the reduced reactance voltage is discussed, and it is stated that the corrected reactance ought not to exceed 4.5 volts.—Lond. *Electrician*, July 2.

Polyphase Commutator Motors.—E. ROTH.—The conclusion of his long theoretical serial on polyphase commutator motors. In the concluding parts the author gives numerical examples.—*La Lumière Elec.*, June 26.

Lamps and Lighting.

Electric Lighting.—Two further communications concerning ways and means of making electric lamps more popular. C. Schmidt recommends a convenient and cheap rate for residences since the lamps are lighted in residences generally after the peak load is over. A flat rate, however, has proved very disadvantageous in Russia, as the people there prefer to use cheap lamps of low efficiency and for long hours, which use increases the load at times of the peaks. He recommends the installation of cheap amp-hour meters and the charging of such consumers a certain minimum flat rate, which he has to pay in advance every three or six months. In longer intervals the amp-hours consumed by the party are read, and if they are beyond a certain amount he is charged for the excess. The Officene Elettriche Genovesi in Genoa, Italy, carries out the wiring itself in large apartment and tenement houses. It also allows a certain amount to anybody who installs at least six lamps in six different rooms. In this way the installation of electric lamps in flats of $120 to $400 yearly rent has been greatly facilitated, and the number of consumers of this kind is about 9000. A flat rate is granted to almost all stores, restaurants, etc., which close after 9 o'clock, with the exception of residences, since in this case control would be impossible. The number of consumers who get a flat rate is about 4000. The cost of installation in such cases is paid by the company, but the consumer must make a contract for several years.—*Elek. Zeit.*, July 1.

Economical Lighting.—W. H. F. MURDOCH.—If n is a number of lamps, each taking W watts and running for A hours per year at p cents per kw-hour, and if each lamp costs s cents and has a life of L hours, and if these n lamps are to be replaced by N other lamps each taking w watts having a life l and costing S cents, then no saving will be effected if

$$p = \frac{\frac{NS}{l} - \frac{ns}{L}}{nW - Nw} \times 1000$$

Generally, therefore, the saving E effected is represented by a straight line, or $E = p\,k - k^1$, when k and k^1 are constants depending on the lamps and p the variable cost of electrical energy. The author gives also a more general formula relating to a large building in which there are numbers of different lamps. The above equation shows that the saving is greater, the greater the difference between nW and Nw. If watt per candle be assumed to be the limit likely to be reached, it is clear that no great saving is made in using fewer high-candle-power lamps. There is a direct saving in replacements, since a higher-candle-power lamp generally costs less than its equivalent in lower candle-power, but this can only affect the annual saving slightly. In wiring the building also, there is the advantage of fewer outlets. It seems unlikely that high-candle-power incandescent lamps will be largely used for interior illumination, so long as the cost of electrical energy remains as at present. It is interesting, however, to speculate as to what would happen if the price per kw-hour was sufficiently reduced to make it worth one's while to use high-candle-power incandescents. "From a consideration of the above expressions we see that for some time to come it is unlikely that high-candle-power incandescent lamps will be in such demand."—Lond. *Electrical Review*, July 2.

Daylight Efficiency.—H. E. IVES.—An abstract of a paper read before the Physical Society on the "daylight efficiency" of artificial light sources. This investigation was prompted by the question whether the newer high-efficiency illuminants might not be screened to resemble daylight without prohibitive loss of efficiency. Daylight is assumed to have the spectral relation to acetylene found by Dr. E. L. Nichols' investigations. Two methods are developed. The first, by a discussion of the colored absorbing screens necessary to reduce a continuous spectrum to the daylight spctrum, and the luminosity values of the different colors of the spectrum leads to a quantity—the ratio of intensity of white light obtained by screening source of daylight color to the intensity of unscreened source—called the "white-light efficiency." The second, by considering the amount of white light which, mixed with a single spectrum ray, will match the colored light, leads to a quantity—the ratio of the intensity of white sensation to the intensity of total sensation—called the "white-sensation efficiency." The white-light efficiency depends upon the arbitrary choice of point from which screening starts, and gives zero value to selective sources of the type of the mercury arc. It gives an indication of a source's suitability for use where color values are to be judged. Numerical values indicate that ordinary sources (glow lamps, acetylene, etc.) have from 20 per cent to 50 per cent available light. A 1.25-watt tungsten lamp may be screened to resemble daylight with a resultant specific consumption of about 4 watts per candle or the consumption formerly considered practical in electric lighting. The white-sensation efficiency is applicable to all types of sources, and accurately describes the color of the light or of a white surface illuminated by it. It gives no idea of the source's suitability for color discrimination. It is, however, independent of any choice of screening and scientifically preferable. The white-sensation efficiencies are always higher than the white-light efficiencies. For the most useful comparison of artificial sources the results of the two methods have been combined by a graphical scheme.—*Phys. Review*, June.

Tungsten Lamp.—A note on a tungsten lamp of British make which has just been placed on the market. It is the 16-cp, 200-volt, 25-watt "Leuconium" lamp. The filament, which consists largely of tungsten, is arranged in the 16-cp lamps in nine loops.

its total length being about 40 in., while the specific consumption of the lamp is from 1.5 watts to 1.6 watts per English candle. A bulb of similar shape and approximately the same size as the customary carbon-filament lamp has been adopted. Nothing is yet stated concerning the life, but the filaments are said to be mechanically strong, and to stand a large amount of vibration. The small candle-power of the lamp is rendered possible by an "improved and, at present, secret method of treating the filament after drawing."—Lond. *Electrician,* July 2.

Generation, Transmission and Distribution.

Rolling Mills.—A note on a recent British patent (18,575, 1908; June 24, 1909) of Siemens Brothers Dynamo Works, C. A. Ablett and H. Crowe, for a method of driving reversible rolling mills. The main motor is separately excited, and supplied with energy from a variable generator coupled with a flywheel to a steam turbine. The turbine, which may be of the high, mixed or low-pressure type, is run at a speed about 25 per cent lower than that corresponding to the most economical steam consumption, this reduction facilitating the construction of the flywheel and generator without seriously reducing the efficiency. By-pass valves for short-circuiting one or more stages of blades, or for admitting the steam to different parts, so that the turbine can deal with sudden overloads, are provided. The turbine speed must be arranged to drop with the load automatically by means of a suitable governor, so that the flywheel can give up some of its energy.—Lond. *Elec. Eng'ing,* July 1.

Steam Condensers.—E. Lunn.—A paper read before the British Municipal Electrical Association on steam condensing and water-cooling plants. The author describes the various types of condensers and the advantages and disadvantages of each. After considering the question of pumps, he finally discusses water-cooling plants.—Lond. *Electrician,* July 2.

Traction.

Baden.—An illustrated article on the electrification of the Wiesenthal Railway, hitherto worked by steam, in the State of Baden, in Germany. Energy is taken from one of the stations on the Rhine near Augst-Whylen, which gives a three-phase supply at 6800 volts and 15 cycles. In order to obtain single-phase energy at 10,000 volts and 15 cycles, for the line, a converter substation has been erected at Basel. In this substation there will be installed two converters, each of which comprises a single-phase generator for a continuous output of 2100 kva. Each generator is coupled on one side to a three-phase, non-synchronous motor, which takes energy from the station supply, and on the other side to a direct-current machine connected to a buffer battery. When the output to the railway is greater than the average, the direct-current machine works as a motor and supplies the extra energy for the single-phase generator. When the output is less than the average, the direct-current machine acts as a generator and charges the buffer battery. The battery is able to discharge momentarily at the rate of 2800 kw. Ten single-phase locomotives, both for passenger and freight trains, will be used. The locomotive contains three central driving axles which are connected by coupled rods to two single-phase motors. These motors are of the multipolar, series-wound type, each motor being capable of giving a continuous output of 390 hp, an output of 525 hp for one hour, or a maximum of 800 hp for short periods, at a pressure of 300 volts.—Lond. *Electrician,* July 2.

Contact Surface System.—Some notes on the experience with the "G. B." system at Lincoln. According to the last annual report of this municipal tramway system the working expenses for the year amounted to 11.2 cents per car-mile, a considerable reduction on the figure of 12.2 cents recorded a year ago. The most interesting feature is the reduction in repairs and maintenance from 2.50 cents to 2.24 cents per car-mile. Of the sum of $3,655 appearing under this heading, $2,610 is allocated to cars—that is, a saving of nearly $300 compared with the previous year, notwithstanding an increase of 7 per cent in the number of car-miles run. Most interest, however, will be taken in the cost of repairs to the electrical equipment of the line, and at first sight the increase from $375 last year to $740 in the present accounts appears unfavorable when it is remembered that the "G. B." Company guaranteed the annual cost of upkeep not to exceed $450. The engineer explains in his report, however, that the latter figure has really not been exceeded since the amount stated in the accounts contains the cost of alterations at a railway crossing, also a sum of $75 for improvements, which will give the parts affected longer life, and of $80 for maintaining feeder cables, cleaning feeder, access boxes, conduits, etc., so that only $410 is chargeable to the direct upkeep of the "G. B." system. This value seems to leave a little margin over the guaranteed figure, considering that the guarantee applied to the first 10 years' operation of the system. Moreover, it is explained that several special repairs have been carried out which are not likely to occur again in the near future, while the stud heads throughout the track have been packed up, so that it is expected the estimated five years' life will be realized. Nevertheless the present repairs and maintenance expenses are considerably higher than those of the majority of tramway undertakings, although the total working costs are considerably below the average.—Lond. *Electrician,* June 25.

Electric Locomotives.—Heyden and E. Eichel.—Two articles on electric locomotives. Heyden discusses details of the gearing system, and Eichel describes a new single-phase locomotive of the Prussian-Hessian railways and also American locomotives for a frequency of 15 cycles.—*Elek. Kraftbet. u. Bahnen,* June 4.

Electric Traction on Suburban Lines.—C. Vogel.—On ordinary steam railroads it is advisable to use electric traction on suburban lines in order to run shorter trains at more frequent intervals. The author describes the storage-battery cars used by the railroad department of Mainz, in Germany, for such purposes.—*Elek. Kraftbet. u. Bahnen,* June 23.

Installations, Systems and Appliances.

Regenerative Boosters.—An article describing the new battery-charging station of the garage of the Brighton Automobile Omnibus Company, where the Stevens regenerative battery-charging system has been adopted. In the same article a description is given of the Stevens system of regenerative boosters for automatically maintaining a constant voltage at the ends of three-wire feeders of varying lengths. The main feature of the system is the application of two or more boosters with their armatures directly coupled on the same shaft or series of shafts flexibly connected together by means of couplings so

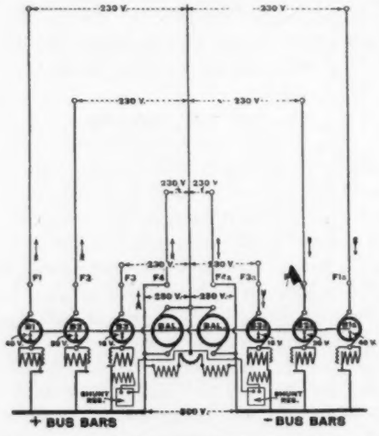


FIG. 3.—MULTIPLE OPERATION OF BOOSTERS.

that all must rotate at the same speed. A line of boosters can be conveniently coupled to each of the outer ends of the balancer shafts, as shown in Fig. 3, so that each feeder, or set of feeders, has a booster armature in series with its positive and negative terminals. Feeders of average length, taking the main load of the station, are not included in the system. The boosters are connected up as shown, those controlling long feeders having their fields series wound, so that the current through the fields raises the voltage across the booster armatures proportionately to the current passing through them; and the volts

across the booster armature can be made equal to the drop in volts in the feeder by adjusting the shunt which is provided with each machine. With this object the fields of the boosters work at a low magnetic density. The voltage across the armature of the booster at no load is zero, and the machine will work automatically throughout all its range, after the shunt is adjusted to the load. As the voltage of the booster is proportional to the current passing through it, it is obvious that the boosters will also act as balancers, as any increase of current demanded on one side of a feeder will be accompanied by an increase of voltage on that side, making up for the increased drop of voltage on the main and in addition providing for the drop in the middle wire for the return current. Boosters which control very short feeders, such as supply energy to the station and immediate surroundings, are provided with a shunt-field winding controlled by a rheostat. The direction of this field is such that the machine runs as a motor and opposes the line pressure, keeping the voltage of supply normal when the station voltage is raised to deal with the drop in the feeders of medium length at peak load. A few turns of series winding acting differentially to the shunt winding will reduce the e.m.f. of the negative boost when the load on the short feeders increases, and the series coils will also tend to balance the load on the short feeders. As an illustration of the action of the system in practice, feeders of varying length are shown in the illustration. Feeder 1 is taken as 3000 yd., 2 as 2000 yd., 4 as 1000 yd., 3 as 200 yd., and the current density at peak is taken for all feeders at 800 amp per square inch; with this density the fall of potential will be approximately 2 volts for each 100 yd. (single) of feeder. On feeder 4, length 1000 yd., representing the average length of main feeders for main supply, the voltage of main busbars, raised at peak load 20 volts on each side of middle wires, will bring the voltage at feeding point to 230. Feeder 3, length 200 yd., will then be lowered by 16 volts, so that the voltage at feeding will be 230. Feeder 2, length 2000 yd., will require a boost of 20 volts on each side in addition to the busbar voltage of 250 to deliver energy at 230 volts to feeding point. Feeder 1, length 3000 yd., will require a boost of 40 volts on each side in addition to the busbar voltage of 250 to supply 230 volts at the feeding point. All boosting with the exception of that on feeder 3 is done automatically.—Lond. *Electrician*, June 25.

Electricity Supply of Berlin.—The various central stations in Berlin sold in January last 655,929 kw-hours less than during the same month of 1908. The company which supplies energy to the suburbs of Berlin, however, increased its output during the month by 372,182 kw-hours. The Berlin central stations, which have usually an average increase in output of 2.6 per cent, thus suffered a reduction in January of 4.1 per cent, and while the company supplying the suburbs has increased its output, it has done so in a much smaller proportion than is usual. The employment of metallic-filament lamps is more extensive in the center of the town, though this latter cause of reduction is only considered temporary. A reduction in the energy supplied to the railways is put down to the fact that the drivers are becoming more skilful and are taking more account of the economical side, for the traffic on these lines is steadily increasing. —Lond. *Electrician*, July 2.

Protection of Three-Phase Feeders.—M. B. FIELD.—When resistors are used in the neutral-earth connection to limit the earth current, they must be constructed to dissipate very large amounts of energy, and when choking coils are employed there is considerable danger of resonance phenomena occurring. The author proposes a method of protecting systems with unearthed neutrals, based on the fact that on a ground connection occurring on any one phase the total capacity current of the cable network will return along the grounded core of the faulty cable. This action causes the cable to have a resultant magnetic effect which is utilized to operate a relay and disconnect the cable without any rush of current.—Lond. *Elec. Eng'ing*, July 1.

Condensers.—K. FISCHER.—An illustrated paper read at the annual meeting of the German Association of Electrical Engineers. The author describes a machine for making condensers of tube form and plate form from tin foil in combination with paper impregnated with resins. Tests of such condensers showed that the watt consumption in the condenser was about 1 per cent of the apparent power. The experiments show that they are sufficiently reliable in operation to make their application for various purposes in practice quite promising.—*Elek. Zeit.*, July 1.

Wires, Wiring and Conduits.

Underground Cables.—J. R. DICK.—An illustrated article on the heating of underground cables, giving diagrams and formulas.—Lond. *Electrician*, June 25.

Insulators.—W. WEICKER.—The first part of an illustrated description of details of construction of suspended insulators.—*Elec. Zeit.*, July 1.

Electrophysics and Magnetism.

Magneto-Optics.—L. R. INGERSOLL.—An account of an experimental investigation concerning the Faraday and Kerr effects for a long range of spectrum; the thickness of the surface layer which gives rise to the Kerr rotation, and the relation between the Kerr rotation and the optical density of the surrounding medium. These problems are studied for the simplest typical case, that of iron in the form of thin films (cathode films). The author describes a bolometric method for measuring rotations, and then deals with rotation dispersion curves for the Faraday and Kerr effects in the infra-red spectrum, and finally with the dependence of the Kerr rotation on the reflective index of the overlying medium.—*Phil. Mag.*, July.

Electron Theory.—J. H. JEANS.—A second paper on the theory of the motion of electrons in solids. The author deals with the radiation of all wave-lengths in a perfectly reflecting enclosure, with natural radiation, and with the dependence of natural radiation on the law of force.—*Phil. Mag.*, July.

Arc Method of Producing Oscillations.—K. W. WAGNER.—The first part of a theoretical paper on the production of alternating current by means of a direct-current arc.—*Elek. Zeit.*, July 1.

Electrochemistry and Batteries.

Fixation of Atmospheric Nitrogen.—Abstracts of a number of papers presented before the International Congress of Applied Chemistry and the Royal Society of London. A. Bernthsen discussed the new electric furnace process of the Badische Company. Two papers by S. Eyde and Professor Birkeland dealt with the Birkeland-Eyde process. N. Caro discussed the calcium cyanamide industry.—*Electrochem. and Met. Industry*, July.

Induction Furnace. —J. HARDEN.—An article discussing in detail the efficiency of induction furnaces, the influence of frequency on the power factor, and the time required for various runs in practice.—*Electrochem. and Met. Industry*, July.

Electrolytic Conductivity and Magnetism.—C. J. REED.—An illustrated description of an observation which appears to show an increase in electrolytic conductivity along lines of magnetic flux.—*Electrochem. and Met. Industry*, July.

Units, Measurements and Instruments.

Vibration Galvanometer.—W. DUDDELL.—During the last few years the use of vibration galvanometers for the measurement of capacities, self-induction and mutual induction has greatly extended, "and in the near future they may be expected to supersede the telephone and possibly the secohmmeter for these purposes." The author describes a new type of vibration galvanometer, in which the mass of the moving parts is reduced to a minimum, the moving coil being reduced to two wires, forming its two sides, similar to a bifilar oscillograph, but with this difference: Whereas the bifilar oscillograph is designed so as to make the damping aperiodic, the bifilar-vibration galvanometer is designed so as to keep the damping as small as possible. The design of the instrument is shown in Fig. 4, in which *a, b, c, d* is a fine bronze wire passing over a pulley *p* and stretched tight by means of a spring the tension on which is capable of variation by a milled head. The wires carry a mirror *M* in the center and are placed in a strong magnetic field between poles *N* and *S* of a magnet. The wires pass over two

bridge pieces, *B, B,* which limit the length of the wires, which are free to vibrate. These two bridge pieces can be moved nearer together or further apart by means of a right-handed and left-handed screw as required. The current to be measured passes up one wire and down the other, causing one wire to tend to move forward and the other back in the magnetic field and so tilts the mirror *M* through a small angle. The

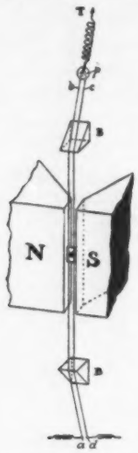


FIG. 4.—VIBRATION GALVANOMETER.

periodic time of the wires depends on their mass, length, tension, as well as upon the moment of inertia of the mirror. In a completed instrument the moment of inertia and the mass of the wires are fixed, but their length and tension can be altered in order to adjust the periodic time. The advantages of the bifilar galvanometer may be summarized as follows: Simplicity, ease in tuning, wide range of frequency for which it can be tuned, high sensibility, negligible self-induction, comparatively small back e.m.f. Its main defect is the small size of mirror that it is necessary to use on the instrument. With a carefully adjusted optical arrangement, and using a small 4-volt metallic-filament lamp, one can work with comfort at a scale distance of a meter in a room which is not too brilliantly lighted.—*Phil. Mag.*, July.

Magnetometer.—J. C. Gray and A. D. Ross.—The authors first discuss the sources of errors found in the ordinary form of magnetometer and then describe a type of instrument in which these sources of errors are eliminated. Its principle is indicated in Fig. 5, where *ns* represents the magnetometer needle provided with a concave mirror, by means of which and a source of light *L* its movements are observed on the scale *SS*. *H* is the magnetizing solenoid placed due east or west of the magnetometer-needle and clamped in a convenient position. C_1 and C_2 are compensating coils placed with their axes approximately in coincidence with that of the solenoid. In adjusting the apparatus the effect of the current in *H* on the needle *ns* is first approximately annulled by means of C_1, which is then clamped in position. The final adjustment of the compensation, so far as the undisturbed position of the needle is concerned, is

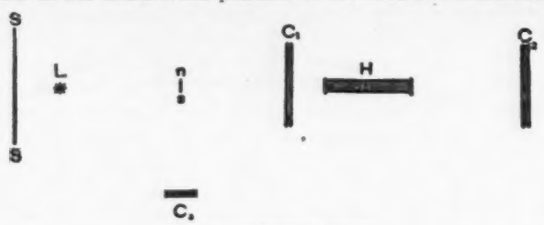


FIG. 5.—MAGNETOMETER.

carried out by means of C_2, which on account of its great distance from the needle contributes only a small fraction of the balancing field, and thus provides an adjustment of great refinement. The position of C_2 necessary for balance having been obtained, it is clamped in position; obviously since the distance of C_2 from the needle is great, any slight movement caused by doing so produces no perceptible effect on the compensation. If the axes of C_1, *H* and C_2 were coincident and passed through the magnetometer needle the adjustment would now be complete. If, however, the needle *ns* is deflected by means of a permanent magnet, and a large current is reversed in the circuit, in general an alteration in the scale-reading on *SS* will be observed. A coil C_3, placed with its axis in the magnetic north and south line passing through the needle, is now included in the circuit. By properly adjusting the direction of the current in C_3, and altering the distance of C_3 from the needle, the compensation can be made perfect for all positions of *ns*. In a magnetometer where *ns*, C_1, *H* and C_2 are all carried on stands moving in one channel in the bedplate, there should be little departure of the axes of the coils from coincidence. Accordingly the resultant magnetic field, due to the coils and solenoid, in the north and south direction will be small. The coil C_3 is, therefore, made of little power, and small change in its position brings about only a very slight alteration in its effect upon the needle. It can, therefore, be clamped without any risk of upsetting the balance.—*Phil. Mag.*, July.

Standard of Wave Length.—J. A. Fleming.—An article on the standard of wave length for the calibration of wave meters. For ordinary laboratory work the simplest method of obtaining a circuit in which oscillations of known frequency can be set up is to combine together a condenser consisting of metallic plates in desiccated paraffin oil, the oil being the dielectric, with a rectangular wire circuit, of which the inductance can be predetermined. Paraffin oil very carefully dried is a dielectric with no sensible leakage and having the same dielectric constant at high frequency as at low. When metallic plates are inserted in this oil one can construct a condenser, the capacity of from 100 mf or 200 mf, by means of a revolving commutator and taken to have that value for high frequency. A circuit can then be constructed for laying one single turn of insulated wire laid in a groove round a rectangular wooden frame and bringing the ends of the wire close together in the center of one side and terminating them in spark balls. The inductance may be calculated by a formula for which a numerical example is given. Lond. *Electrician*, July 2.

Instrument Transformers.—P. G. Agnew and T. T. Fitch.—An abstract of a paper read before the Physical Society on an investigation carried out in the Bureau of Standards on the determination of constants of instrument transformers. The constants to be determined are the ratios and phase angles between primary and secondary. In the case of shunt instrument transformers this is accomplished by drawing from the source of supply a small current through a non-inductive resistor of high resistance and applying the secondary to this resistor in potentiometer fashion, using as detector the moving coil of a dynamometer whose field coil is in the primary circuit. This arrangement makes the ratio depend directly on two bridge values of the resistance. The phase angle is obtained with the same arrangement by applying the small resultant e.m.f. to the moving coil of a dynamometer whose field is excited by a current in time-quadrature. A maximum sensibility of 1/20,000 in ratio and of 0.1 ft. phase angle is obtained. A similar method is used for the ratio and phase angle of series transformers. Measurements on a considerable number of transformers showed that the shunt transformer is a device of high precision, and that the same is true of the series transformer, but to a less degree. It was found that in case the secondary of a series transformer is open-circuited while current is passing through the primary, the constants are changed, due to the permeability of the iron being decreased, but that this effect can be removed by demagnetization. In connection with the work a method was developed for the comparison of extremely low inductances with an accuracy of 1 per cent.—*Phys. Review*, June.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—An illustrated description of the new Telefunken apparatus, giving outside views of the sender variometer, the singing spark-gap, the primary condenser, a 2-kw sender, a complete wave measurer, acoustic receiver for all wave lengths, and a complete military sending apparatus on a truck.—Lond. *Electrician*, July 2.

BOOK REVIEWS.

LE FRODI NEI MISURATORI ELETTRICI. By Lanfranco Mario. Milan: Ulrica Hoepli. 278 pages, 27 ills, 39 plates. Price, 4.50 lire.

This interesting volume is devoted to an analysis of the various errors that can be imported by fraudulent means into the registration of customers' meters whereby the records may be reduced. A very considerable amount of ingenuity seems to have been exerted in developing methods of preventing meters from recording the full amount of electric energy that has passed through them. Corresponding amounts of study and ingenuity have been involved in diagnosing and in remedying such defects in the meters. The work is divided into four parts. The first deals with the nature of fraudulent errors in meters. The second takes up controlling and detecting apparatus for revealing defects in meters. The third part discusses the installation of detectors, and the fourth relates to other types of instruments which may serve as differential detectors. The book is the most complete study yet published on the subject.

THEORIE DER ELEKTRICITÄT. By M. Abraham. Leipzig: B. G. Teubner. Vol. II, second edition. 404 pages, 6 ills. Price, 10 marks.

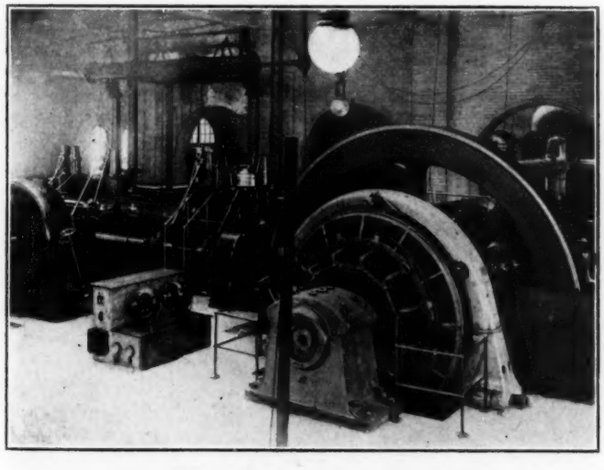
This is the second volume of the theory of electricity by Dr. Abraham and is devoted more particularly to the theory of electromagnetic radiation. It is essentially a mathematical treatise prepared by a mathematician for the use of students of mathematical physics. This is shown by the fact that while there are over 270 principal equations in the book, there are only six illustrations, and these of a very simple geometrical character. The book is useful as formulating the modern theory of electromagnetic radiation in connection with the doctrine of electrons. It is clearly written and eminently worthy of study by advanced students.

NEW APPARATUS AND APPLIANCES

Double-Acting Gas Engines.

In the accompanying illustration is shown an Allis-Chalmers horizontal, double-acting tandem gas engine, of 500 hp, driving a direct-current generator of the same company's build in the power house of the Illinois Steel Company's Bay View Mills, at Milwaukee, Wis. It is stated that during the two years this has been in operation the unit has not cost $50 for repairs, and its record has been such as to demonstrate conclusively the reliability of gas engines, properly designed, for industrial service of the most severe character.

Machines in operation for about the same period of time, or longer, include gas engines and generators of from 300-hp to 5000-hp capacity, which, with others now going into commission, furnish power for iron works, steel mills, clay-products

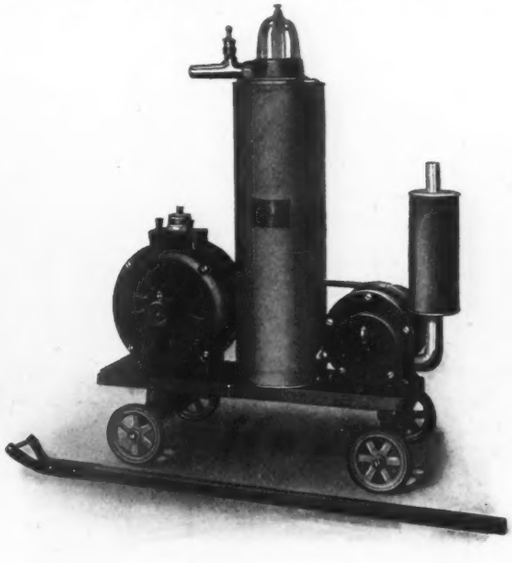


DOUBLE-ACTING TANDEM GAS ENGINE.

plants, cement mills, automobile shops, plate-glass works, tube mills, wire works, central power, lighting and traction stations, phosphate plants, factories and other industrial establishments. In the list are engines operating on producer, natural and furnace gas, and their capacity for continuous service aggregates no less than 210,000 hp. Among the larger users of gas power in the industrial field is the Pittsburgh Plate Glass Company, which was one of the earliest to install the improved type of engine and electric generator built by Allis-Chalmers Company, and has just placed an order for the eleventh of these units.

Vacuum Cleaning Outfit.

A vacuum cleaning set, shown in the accompanying illustration, recently put out by Hanlon & Wilson, of Wilkinsburg, Pa., is said to be an exceptionally well-made and efficient machine. The motor is rated at ½ hp, and may be either alternating or direct current. It is belted to a rotary pump, and the whole machine, which weighs about 140 lb., is simple, compact and durable. The apparatus is known as the Vak Klean machine, and it is mounted on a small truck equipped with rubber-tired wheels. Various attachments are supplied for cleaning carpets, rugs, draperies, mattresses, furniture,

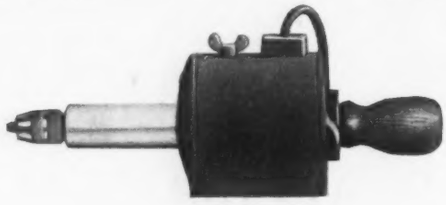


VACUUM CLEANING OUTFIT.

floors and ceilings. They are attached at the end of a flexible tube, and the dirt is drawn out from the parts being cleaned and deposited in a canvas bag inside the dirt separator, shown prominently in the center of the machine. A flexible connection is also provided for attachment to a suitable source of current supply. The Vak Klean machine is made in two sizes. The one designed for use in private dwellings is that illustrated herewith. The larger machine is operated by a 2-hp motor, and is suitable for churches, office buildings, theaters and public buildings. This machine may be made either portable or stationary, as desired.

Portable Electric Breast Drill.

The Willey Machine Company, of Jeffersonville, Ind., has brought out a portable breast drill with a chuck for drills up to ¼ in. in size. The drill spindle has two long bearings, with removable bushings of phosphor bronze, in place of a single short bearing. By simply removing two nuts, the entire machine can be taken apart by any ordinary mechanic for inspection of the enclosed mechanism, no electrical knowledge being necessary. All the electrical connections are attached to the main casting of the machine and are not disturbed when it is taken apart for any purpose. A snap switch is located on the side of the frame convenient for starting and stopping the drill.



BREAST DRILL.

Special attention is said to have been given in designing the tool to the ventilation of the device so as to insure cool running and high-efficiency of the motor. Simplicity in construction is a matter which has received careful consideration by the company in making a machine which would be durable under the rough usage to which tools of this kind are often subjected in service.

Electric Glue Spreader.

The Advance Machinery Company, Toledo, Ohio, has brought out a line of electrically heated glue spreaders which are similar to its regular line of steam-heated spreaders, except they are supplied with electric coils for heating the water in the jacket which surrounds the glue receptacle. The coils are provided with three-way switches which enable the user to maintain his glue at any one of three temperatures—minimum, medium or maximum. The maximum current is required for about 20 minutes in the morning, after which the minimum current will be sufficient to keep the glue at 150 deg. to 160 deg. temperature

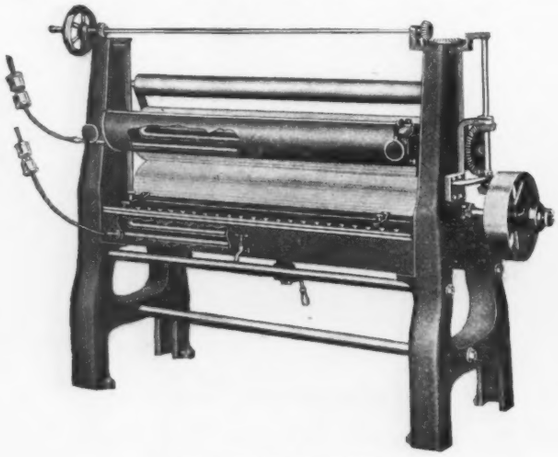


FIG 1.—GLUE SPREADER.

all day long. It is stated that the cost for energy is very little, if any, greater than the cost for steam.

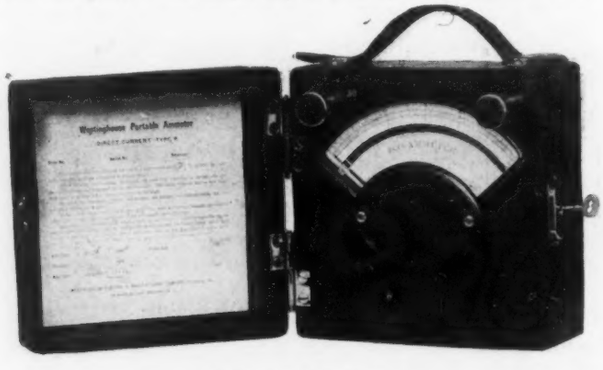
The spreader is also supplied in combination with an electric glue heater, the latter being connected in such a way to the spreader as to supply hot glue through troughs attached to the heater and the spreader. The glue spreaders are provided with copper glue receptacles which not only keeps the glue clean and in good condition, but is stated to reduce the consumption of energy to less than one-half of what it would be if any other metal were used. The spreaders are provided with an automatic "take-up" to compensate for different thicknesses of stock from nothing up to 4 in.—i.e., the upper roll automatically

FIG. 2.—GLUE SPREADER.

adjusting itself for the different thicknesses of stock. If the operator is gluing stock 1/16-in. thick, he can run one piece through of this thickness and the next piece of 4-in. thickness, if necessary, without making any adjustments whatever.

Direct-Current Portable Meters.

The Westinghouse Electric & Manufacturing Company is placing on the market a line of direct-current meters known as Type A. Some features embodied in these instruments are their excellent "dead beat" qualities, practically uniform scale, polarity indication, freedom from effects of temperature change or external field, adaptability for use with shunts, and absence of residual errors. These are some of the advantages that follow from the use of the D'Arsonval type which are not found in the "moving-iron" type. The single air-gap construction employed enables the moving coil to be moved without disturbing the magnetic structure by opening the magnetic circuits and thus permanently weakening the magnets. This facilitates the making of repairs by the meter user. The construction is especially suited for portable meters because the coil and pointer balance each other on the moving element. There is ample clearance between the magnet pole-tips for the moving coil, while the reluctance of the single gap is not high. The ammeters are



PORTABLE AMMETER.

either self-contained with double range or have separate shunts, the large sizes, of course, having external shunts. These shunts are interchangeable, and are made of a special alloy which has zero temperature coefficient and avoids all error due to the thermoelectric effect of difference in temperature between the alloy and copper terminal junctions. The meters are put up in walnut cases, 6¼ in. x 6¼ in. x 4 in., and weigh about 5 lb. They are made for any current or voltage.

Theater Dimmer.

The Ward Leonard Electric Company, of Bronxville, N. Y., has placed upon the market a new type of theater dimmer which has been designed to occupy a minimum of space. It is similar to the standard enameled, interlocking dimmer plates made by the same company, which have been in service for the past 12

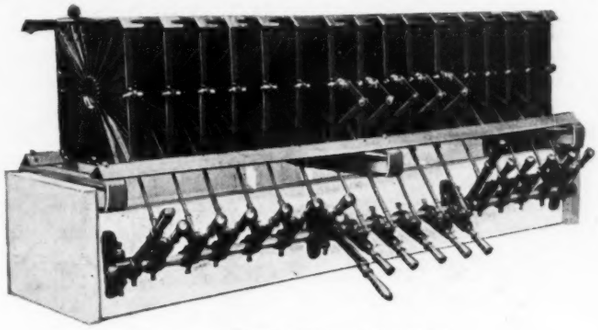


FIG. 1.—HAND-OPERATED DIMMERS.

years or more, but is of a square 14-in. x 14-in. size instead of 15-in. x 24-in. size. It can be placed in any location or position, and controlled from a distance by direct-rod drive, which insures even regulation. The new dimmers are designed principally for circuits of 25 amp or less. The 15-in. x 24-in. dimmers will carry 50 amp per plate maximum.

Fig. 2 shows one of these dimmers arranged for three-wire,

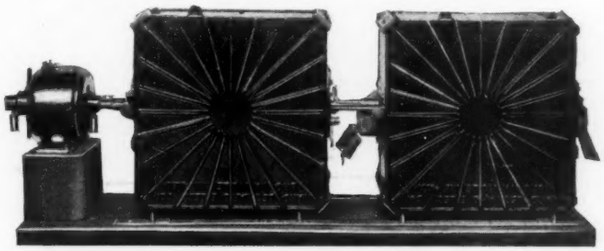


FIG. 2.—PUSH-BUTTON DIMMER.

push-button control. The controlling shoes are driven by a small motor.

Fig. 3 shows a large house dimmer, motor-driven, for a three-wire circuit and having a capacity of 1200 lights. There is an increasing demand for motor-driven dimmers of large capacities, because the rheostat can be mounted in any con-

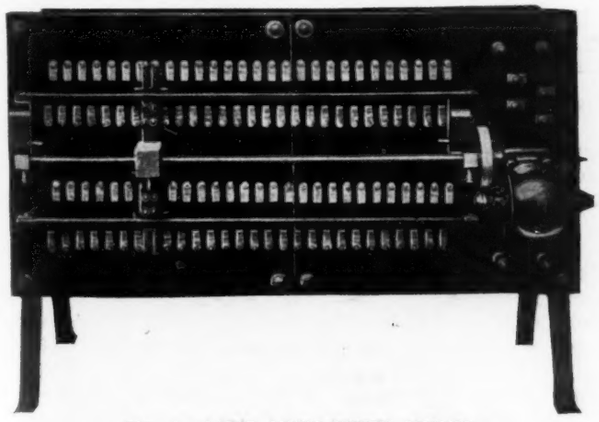


FIG. 3.—LARGE MOTOR-DRIVEN DIMMER.

venient place and at any distance from the dimmer board, while the push buttons can be located directly in the dimmer board. The resistance of this large dimmer is made up of standard Ward Leonard strip units. There are no multiple parts and no wire connections, while the resistance is of the zero temperature, non-inductive and non-oxidizing type.

Mercury Type Ammeter.

The problem of measuring large alternating currents with any degree of precision is, from a technical standpoint, a difficult one. All who have had any experience in this class of work agree that there is need for a standardization instrument which can be inserted directly into an alternating-current circuit carrying 500 amp and over which will measure this current with the same degree of precision that small currents may be measured.

As a suggestion toward an instrument which would meet these conditions E. F. Northrup proposed, in 1907, an alternating-current ammeter based on certain forces, and built a crude instrument. Since that time, the Leeds & Northrup Company has steadily perfected this instrument until it has reached a point where, practically speaking, the only limit to accuracy of the instrument is the accuracy to which the ultimate unit of current is known.

The company states that its new instrument, which is designated the "mercury ammeter," is intended for use as a primary standard instrument for large currents, either alternating or

FIG. 1.—MERCURY TYPE AMMETER.

direct. It is intended for the calibration of station instruments and for use in the determination of series-transformer ratios. However, its very small resistance, together with the absence of inductance in the instrument, open to it a number of uses in the alternating-current field which are closed to instruments possessing impedance. The mercury ammeter is intended for use in the measurement of currents of 200 amp and over. The lowest practical range in the present type of instrument has a full scale corresponding to 500 amp, and this instrument on 200 amp may be read to 1/5 per cent accuracy. The standard length of the scale is about 22 in. Tests have been conducted on a number of these instruments, using the potentiometer with direct currents and Kelvin balances with alternating current as calibrating instruments. It has been shown that the mercury ammeter may be read over three-quarters of the scale to an accuracy of 0.1 per cent, this accuracy being totally independent of the kind of current being measured; that is, the same instrument is equally accurate upon direct current and alternating currents of any wave form, and any frequency up to 133 cycles. The scale follows the "square law," and the reading is in terms of the mean square value of the current. Also, the tests have shown that the temperature coefficient of the instrument is negligible when it is used as a standard. A great deal of care was exercised in the determination of the effects of external currents upon the indications of the instrument. The results showed that appreciable errors resulted only when conductors, carrying heavy currents, were placed directly over or directly under the instrument in contact with the base. For instance, when a conductor carrying a current equal to the full scale reading of the meter (2000 amp) was placed over the base of the instrument parallel to its length, and in immediate

contact with it, a 0.3 per cent error resulted. This was the maximum error; when the distance between the conductor and the instrument was increased, the error rapidly diminished.

With regard to the constancy of the mercury ammeter, an instrument built in 1907, embodying all of the essentials of the present instrument, at the present date, is said to show no perceptible change. It has a period of about five seconds; that is, it will pass from 0 to full-scale reading in five seconds. For facility of reading the meter is built to be just short of dead beat. Fig. 1 shows the instrument and Fig. 2 gives various cross-section views, which show very clearly the simplicity of construction and the complete absence of springs, valves, etc.

The operation of the instrument is quite simple. The copper terminals of the instrument are bolted into the circuit without any regard for polarities. The zero of the instrument is roughly adjusted by leveling and finally by turning the thumb-nut at the top of tube. The current is then thrown on and the colored liquid will flow up to a point in the scale corresponding to the current flowing. Current is then read directly from the scale.

A very simple analogy will serve to make clear the essential principle of the instrument. Wires, when carrying current, tend to attract each other so that were they fastened at the ends they would swing together at their center. A liquid conductor may be considered as being made up of an infinite number of elemental conductors, parallel to the directions of flow of the current. With this in mind, in the cross-section views of the ammeter, the right-hand and left-hand sections will be seen to be very similar in construction, and to consist of copper plates alternating with insulating plates, having various holes drilled in each side and closed reservoirs for mercury. Referring to the cross-sections on *EF* and *CD*, the current, for instance, enters through the upper copper leaf. To get to the next copper leaf of the cell it must pass through the mercury-filled space within the ivory ring. (Ivory ring shown dotted in cut.) In passing through the disk of mercury it causes the mercury to tend to flow away from the edges and "bank up" at the center. The force causing this action is exactly the same force that causes solid conductors, carrying current, to tend to attract each other. This attraction toward the center causes mercury to flow through two diagonal tubes, which tubes extend from the circumference of the disk of mercury to the center reservoir of mercury. Thus a force is set up which tends to make the mercury flow through tubes and disks of sections *CD* and *EF* and through the connecting tube in the base of the instrument from *CD* to *EF*. In the meter in question there are four points at which the force is exerted, two being in section *EF* and two in *CD*. This force causes mercury to flow until it is just balanced by the force due to the difference in hydrostatic head between the levels of the liquids in the two sides. The ammeter consumes about 1 watt per inch of scale reading, regardless of the amount of current to which 1 in. of scale corresponds.

The calibration of the instrument is dependent only upon the number and diameter of the disks or cells, the density of the liquid which serves as an indicator and the force of gravity. The liquid is not exposed to evaporation and, due to the fact that the instrument involves only hydrostatic heads, the effect of variations in the diameter of the index tube is eliminated, as is also the possibility of error due to "drainage effects." Within wide limits the calibration is also independent of temperature changes.

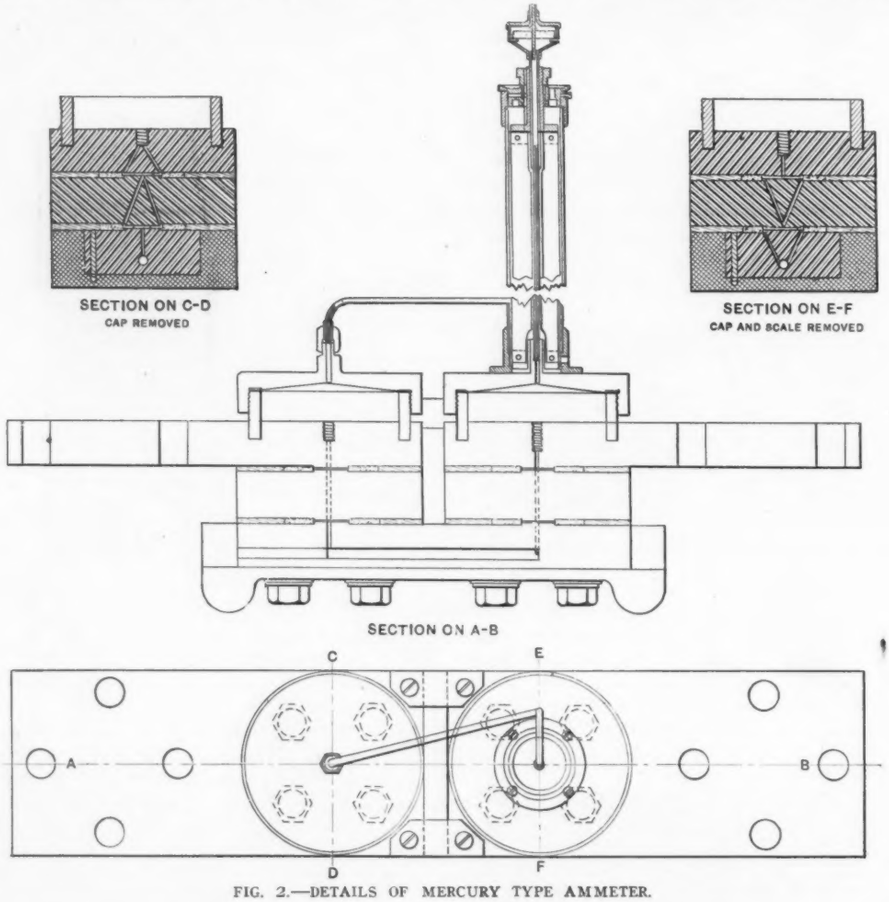


FIG. 2.—DETAILS OF MERCURY TYPE AMMETER.

The instrument involves the application of new principles in instrument design. Its development necessitated the satisfactory solution of a large number of incidental structural difficulties of a type totally different from those normally arising in electrical measuring instruments. The accuracy of this completed instrument, its simplicity, together with entire absence of all corrections, are claimed to make it well-nigh ideal considered solely as an instrument, while the fact that it performs a function for which no other tool is at all feasible causes the maker to believe that the mercury ammeter is destined to occupy a position alongside of the potentiometer and the dynamometer as a high-precision standardizing instrument.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

There is no doubt that there has been a distinct improvement in trade conditions during the past week. The improvement in the crop situation has done much to stimulate buying with the result that the retailers report much better results from their midsummer clearance sales and the wholesalers and jobbers are in receipt of more liberal orders. This is especially true in the Central West where the volume of trade has shown a steady increase and the prospects for future business are most encouraging. In Chicago there is a better feeling in the wholesale trade than there has been since the beginning of the term of depression, two years ago. The South and Southwest especially have been buying. In the dry goods and textile lines these purchases have been especially notable. It is the general impression of manufacturers that stocks of merchandise are not large, either in the hands of retailers or at the central distributing points. This belief is encouraging the manufacturers to expand to some extent and more workmen are now employed than at any time within the past two years. In some sections the threats of strikes and the general dissatisfied condition of the wage earners is giving some uneasiness. This condition is undoubtedly due to the upward tendency in the level of commodity prices and the consequent restriction in the purchasing power of the dollar. The iron and steel industry has lost nothing of its activity. Specifications for steel rails, and for all other finished goods, are coming forward in good volume. Structural steel is especially active and many orders are being filed for delivery in the fall and as far ahead as early next year. The equipment companies are unusually busy. Orders for cars, both of steel and wood, and for locomotives are being received in liberal quantity. This, in a measure, is due to the expectation of liberal crops. It is the general opinion of railroad managers that unless the present equipment is largely augmented there will be serious freight congestion early next year. The electrical companies report better business, but they have not enjoyed the rush that has come to the iron and steel industries. Orders for large equipment continue to be scarce, while the volume of small business is much improved. The earnings of the railroads are steadily improving and the number of idle cars is daily growing smaller. Collections continue to be irregular but are somewhat better than a few weeks ago. The forced sales of retailers stocks have done much to help along this condition. Failures for the week ended July 22, as reported by *Bradstreet's*, were 239, as compared with 206 the previous week, 263 in the same week of 1908, 155 in 1907, 171 in 1906 and 197 in 1905.

THE COPPER MARKET.

The most important happening in the copper market since the last report in these columns, is the revolution in the methods of the Metal Exchange, in New York, taken in recognition of the criticisms of the investigating committee appointed by Governor Hughes. The board of managers of the exchange have adopted the recommendations of the reform committee, which provide that quotations of copper—as well as tin, lead and spelter—shall be based only on actual transactions and that the London system of grading copper as "standard" instead of "lake," "electrolytic" and "casting" shall be used. The change goes into effect Aug. 2. The new rule with regard to copper recognizes no grade but "standard," but fixes arbitrary price allowances for various degrees of purity. The rule reads: "Copper dealings shall be confined to standard copper and no other grade of copper shall be quoted. The minimum of contracts for standard copper shall be for 25 tons of 2240 lb. each, and the contract shall be in the form of the London standard warrant contracts. Sellers of copper contracts have the option to deliver as follows: Class A—Refined copper assaying not less than 99 per cent and below 99.30 per cent at contract prices; class B—Refined copper assaying not less than 99.30 per cent and below 99.80 per cent at ⅛ of 1 cent per pound over contract price; class C—Refined copper assaying not less than 99.80 per cent at ¼ cent per pound over contract price; class D—Rough copper subject to a rebate of ⅜ of 1 cent per pound from contract price. For rough copper the standard of produce shall be 97 per cent, but no excess shall be paid for. A pro rata allowance shall be made for deficient produces below 97 per cent down to and including 96 per cent, and a double pro rata allowance on the same basis for deficient produces below 96 per cent down to and including 94 per cent. Produces below 94 per cent shall not be good delivery." Copper stored in warehouses at the port of New York shall be good delivery as also shall be negotiable receipts of the principal refineries in this section. A commission of $1 per ton is provided for each sale and purchase on the floor of the exchange for an outside party. It is believed that these changes will result in making New York the speculative copper market of the world as 55.4 per cent of all the copper produced is mined in this country. Prices for copper during the past week have been uncertain, advancing slightly when there was any disposition to buy and receding when the demand slackened. In London the speculative market has been active and quite a large volume of copper was sold, which, it is said, was largely for the American account. At the close of the week under review prices in this market were a trifle lower. Exports continue to be very liberal and it is probable that the shipments for July will reach 35,000 tons, which will exceed even the high record made in June. Up to and including July 26, the exports for the month were 29,280 tons. Metal Exchange quotations on July 26 were:

Lake	13⅜ @ 13½
Electrolytic	13 @ 13⅛
Casting	12⅞ @ 13

The London prices July 26 were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	59 16 3	59 11 0
Standard copper, futures	60 11 3	60 5 0
Market	Easy	Easy.
Sales of spot		900 tons
Sales of futures		1,400 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	.....	.....
Lake	14.55	12.55
Electrolytic	14.25	12.12½
Casting	14.12½	12.00
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	55 10 0
London, best selected	67 15 0	59 0 0

SHORT-COMINGS OF AMERICAN EXPORTERS.—Vice-Consul Dirk P. De Young, of Santos, Brazil, in a recent report criticises American exporters for lack of knowledge shown in dealing with Brazil trade. There is, he says, no end of trouble caused by the ignorance of American exporters of how to classify their own goods to meet the requirements of the Brazil tariff, and an instance is quoted where this led to duty being assessed 200 per cent over what it would have been under a proper classification. He states that articles are being held in the Santos custom house subject to storage charges in excess of their value because the New York shipper did not send the necessary documents to enable the goods to be cleared. He says further that it is a source of considerable humiliation to those representing American interests that a large percentage of American letters arrive short of postage; if there is only a two-cent stamp, the overdue charge is nine cents.

AMERICAN MONORAIL COMPANY.—Arrangements have been made by the American Monorail Company to construct a line three miles long through Pelham Bay Park and City Island from Bartow Station on the New York, New Haven & Hartford Railroad to Belden's Point at the extreme end of City Island. It is said that work upon this line will begin early in the fall. It is also claimed by interests associated with the Monorail company that plans have been prepared which include the double-decking of both the Second Avenue and the Third Avenue elevated lines for the accommodation of the monorail system. It is intimated that the Interborough Rapid Transit Company is furnishing the capital for the construction of the experimental monorail line. The Interborough company owns control of the City Island Railroad Company and also of the Pelham Park Railroad Company, the two concerns which have

been operating a horse-car line over this route. Recently, the Interborough company transferred its interest in these subsidiary companies to the Monorail Construction Company, which latter is building the experimental line. The two monorail companies some time ago applied to the Public Service Commission for permission to issue $100,000 of bonds, $55,000 of which were to take up outstanding liabilities and $45,000 to be used in constructing the new road. The commission declined to allow the issue until some explanation had been made as to what became of the money realized from the former issue. This explanation has not been given and the monorail experiment had to be financed in some other way.

IMPROVEMENT IN TELEGRAPH BUSINESS.—According to Mr. R. C. Clowry, president of the Western Union Telegraph Company, the business of the company last week was the best ever recorded. He said: "Not since 1907 have matters been so generally encouraging as at present. The business is naturally stimulated through the increased commercial and industrial activity, and we look forward to a season of good earnings. It has been argued that the telegraph has been made to suffer through the popularity of the telephone. This is not stating the matter fairly. There is no doubt that the telephone business has increased enormously and that some of it has been at the expense of the telegraph. But at the same time the two systems work hand in hand. The Western Union has 'phones in every office throughout the country and the number of messages sent in for further transmission is hardly appreciated. Factories and points away from the regular branch offices use the 'phones extensively and this does away with a large number of messengers." On the other hand, the *Wall Street Journal* states that of 80 of the principal railroads of the country that have been sounded with reference to their attitude toward the telephone as a successor to the telegraph, a large majority declare themselves in favor of the change and 50 announce that an extension of their telephone systems already in operation is contemplated. These roads operate 211,681 miles of track and at present have equipped for experimental purposes 11,632 miles along which 1,400 telephone instruments are used.

BRILLIANT ELECTRIC COMPANY'S MIDSUMMER CONFERENCE.—The Brilliant Electric Company, of Cleveland, Ohio, has extended the idea of business staff reunions by adding provisions for the participation of representatives of jobbers in the discussion of questions affecting the latter. At a conference held at Cleveland and Put-in-Bay, July 19-21, besides the home and branch office staff of the Brilliant company, 20 jobbers handling Brilliant lamps were present. During the several days social enjoyment and business discussion were suitably alternated. Papers were read by the members of the staff of the Brilliant company on various subjects related to the incandescent lamp industry, and among guests who presented papers were Messrs. T. J. Creaghead, of Cincinnati; F. W. Loomis, of the Holophane Company, and M. G. Campbell, of Kansas City.

EASTERN COLORADO HYDRO-ELECTRIC DEVELOPMENT.—The new construction in connection with the Eastern Colorado Power Company's power development is attracting a great deal of popular attention through railway excursions arranged to view the progress. The Barker Meadow dam, which is situated just below Nederland, is already about 30 ft. above bedrock, and progressing rapidly. The dam will be of concrete, with a maximum height of 186 ft., impounding about a half billion cubic feet of water. The contract price is $600,000, and it is to be completed in June of next year. The company will commence storing water in the fall of this year, and should be furnishing energy from his plant, which will be run in conjunction with the 100,000-volt development of the Central Colorado Power Company, by the summer of next year.

IMPROVEMENTS IN JOPLIN, MO.—Henry L. Doherty & Company, who control the electric light and power plants in the neighborhood of Joplin, Mo., are about to contract for a new 10,000-kw steam turbine generator. A new power house will be constructed and 3000-hp Stirling boilers have been purchased. The transmission lines, which will extend in all about 60 miles, reaching the various mining camps in that section, will carry a current at 33,000 volts. The energy will be delivered to the customers at 2300 volts and substations with transformers will be located in each of the mining camps. These properties are being put in first-class condition since they were taken over by Mr. Doherty.

COPPER FOR WESTERN ELECTRIC.—One of the largest sales of copper during 1909 was that made recently to the Western Electric Company, when between 25,000,000 and 30,000,000 lb. changed hands, at a price close to 13 cents a pound. It is said that this copper will cover the requirements of the company throughout the balance of the current year. The reason assigned for buying so liberally at present was that the outlook for gross business for the next six months or a year is now so well established that the company can definitely estimate its requirements of raw materials. At the present time the company is doing a gross business running at the rate of $50,000,000 per annum, and with the monthly increases that have been shown since Jan. 1, this rate should advance to at least $60,000,000 by the last of December.

CENTRAL COLORADO POWER COMPANY.—The Central Colorado Power Company is now supplying the Denver Gas & Electric Company with 1500 kw. It is said that the amount will be increased to 4000 kw in the near future. The Denver Gas & Electric Company has recently contracted for two 750-kw generator units to replace the apparatus destroyed by the recent explosion in its power house. Two new boilers have also been installed.

FRANCO-CANADIAN TARIFF AGREEMENT AFFECTS ELECTRICAL MANUFACTURES.—The Franco-Canadian tariff agreement recently ratified is stated to place at a disadvantage the importation into Canada of American machine tools and electrical motors, generators, and fixtures of various types, particularly of the smaller sizes.

ENLARGEMENT OF CANADIAN ACHESON WORKS.—The International Acheson Graphite Company is enlarging the output capacity of its branch works in Niagara Falls, Ontario. A new furnace room providing for a 1000-hp unit is being built, and on completion the new furnace installation will be placed in operation.

STORAGE BATTERY PURCHASES.—The Atchison, Topeka & Santa Fé Railroad has made a large purchase of car-lighting storage batteries from the Electric Storage Battery Company, of Philadelphia.

Financial Intelligence.

THE WEEK IN WALL STREET.

Although trading in the Wall Street stock market during the past week has been very much contracted, the general tone of the market has been strong and a number of issues have made new high records. What trading there has been in the market has been obviously of a professional character and outside participation has been very small. The main interest of the week has been shown in the Western railroads and in a few of the leading industrials, especially United States Steel. The explanation of these preferences is entirely logical. The crop reports indicate that the yield of the fields will be not only the largest, but by far the most valuable in the history of the country, and this, of course, means increased traffic for the Western roads and increased prosperity for the section through which they run. In the case of the industrials the strength is directly attributable to the improved condition of their business. In every line more orders are being booked and the percentage of operation is more nearly approaching normal. In the iron and steel industry the mills are practically running at capacity and prices are being advanced to a point where the operations will be remunerative. Among the rumors that helped stimulate activity during the week were those concerning increased dividends upon Union Pacific and United States Steel common. The result of these rumors was that the Harriman issue reached 199½, its high record mark, and still held comfortably above 70. The return of Mr. Morgan from his annual jaunt abroad was also used as an argument for advancing prices. His expression was decidedly optimistic for the future of business both in this country and in Europe and it is generally believed that no serious decline in the market will be permitted while he is in this mood. After remaining apathetic on the subject for many months Wall Street has at last awakened to an interest in the tariff. This interest is not, however, so much as to what the new tariff schedule will be, as it is, as to when the rates will be fixed. Wall Street, very rightly, believes that business will adjust itself to any rates that may be adopted, but that the long delay and uncertainty have a paralyzing effect. The tariff uncertainty is being used, too, by those—and their number is not

insignificant—who are seeking lower levels for stocks. There is undoubtedly quite a considerable element in the Street which would like to see prices recede. While these people are timid about making any bear demonstrations, they constantly preach that prices are in excess of values. On July 26, the last day under review, this element succeeded in causing some reaction, but it was of little importance and the volume of trading was light. Money continues to be wonderfully easy and cheap and the demand for bonds is still eager. Quotations on July 26 were call, 1¾ @ 2 per cent; 90 days, 2¼ @ 2½ per cent. The quotations in the table are those of the close July 26.

NEW YORK.

	July 19.	July 26.	Shares sold		July 19.	July 26.	Shares sold
All.-Ch.	15¼	15*	400	Int.-Met., pfd.	47½	45	35,960
All.-Ch., pfd..	51⅞*	53	400	Mackay Cos...	81*	82	1,300
Amal. Cop....	81⅞	82⅞	118,200	Mackay Cos.,p.	74⅛*	73⅞*	300
Am. D. T.....	30*	30*	———	Man. Elev....	147*	145*	600
Am. Loc.....	61¼	62	24,500	Met. St. Ry...	20*	20*	100
Am. Loc. pfd.	119*	120½	815	N.Y. & N.J.Tel	140	139⅞	2,310
Am. Tel. & Cbl.	84	84*	———	Steel, com....	71⅞	70⅛	512,850
Am. T. & T...	140⅝	140¼	12,250	Steel, pfd.....	127⅝	126½	27,550
B. R. T.....	78	77⅜	6,260	W. U. T.....	72¼	73½	3,000
Gen. Elec.....	166	166¾	9,350	West'h, com...	85	84½	9,000
Int.-Met., com.	15½	14¼	18,600	West'h, pfd...	124½*	124½*	———

PHILADELPHIA.

	July 19.	July 26.	Shares sold		July 19.	July 26.	Shares sold
Am. Rys.....	....	45½*	———	Phila. Elec....	12	11⅞	———
Elec. Co. of A.	12⅜	12⅜*	———	Phila. R. T...	29¼	29	———
Elec. St. B'ty.	54¾	56½	———	Phila. Trac....	90½	90½*	———
E. S. B'ty,pfd.	....	49*	———	Union Trac...	53½	53½	———

CHICAGO.

	July 19.	July 26.	Shares sold		July 19.	July 26.	Shares sold
Chi. City Ry..	180	180*	———	Chi. Tel. Co...	132½	133	———
Chi. Rs.,Ser.1.	112	119	———	Met. El., com..	15½	16*	———
Chi. Rs.,Ser.2.	39	38	———	Met. El., pfd..	47	47¼*	———
Com. Edison..	120½	120	———	Nat'l Carbon..	90	91*	———
Chi. Sub'ws...	20	20¼	———	Nat'l C., pfd..	118	119*	———

BOSTON.

	July 19.	July 26.	Shares sold		July 19.	July 26.	Shares sold
Am. T. & T...	140⅝	140¼	———	Mex. Tel.....	2¾	2¾*	———
Cum. Tel.....	137½	137½*	———	Mex. Tel., pfd.	....	6*	———
Edison E. Ill..	250*	250	———	N. E. Tel.....	133¾	134	———
Gen. Elec....	164*	167	———	W. T. & T....	10⅜	10¼*	———
Mass. E. Ry..	13½	12	———	W. T. & T., p.	86	86*	———
Mass E. R.,p.	74*	73¾	———				

*Last price quoted.
Sharles sold are for week July 19 to July 24.

DIVIDENDS.

Guanajuato Power & Electric Company, 1½ per cent on preferred stock, payable Aug. 1.

American Gas & Electric Company, quarterly 1½ per cent on preferred stock, payable Aug. 2.

Western Telephone & Telegraph Company, semi-annual 2½ per cent on preferred stock, payable Aug. 2.

Montreal Light, Heat & Power Company, quarterly, 1¾ per cent, payable Aug. 14.

Butte Electric & Power Company, quarterly, 1¼ per cent on preferred stock, payable Aug. 2.

Helena Light & Railway Company, quarterly, 1¼ per cent on the preferred stock, and 1 per cent on the common stock, payable Aug. 2.

Ohio Traction Company, quarterly, 1¼ per cent on the preferred stock, payable Aug. 1.

Central District Printing & Telegraph Company, quarterly, 2 per cent, payable Aug. 2.

Chicago Railways Company, dividend of 8 per cent on series 1 certificates, payable Aug. 2.

THE UNION RAILWAY GAS & ELECTRIC COMPANY, recently incorporated at Trenton, N. J., with a capital stock of $18,000,000, will be a holding company for the interests of E. W. Clark & Company, Philadelphia, and Hodenpyl, Walbridge & Company, New York. It has for its officers: Anton G. Hodenpyl, president; Clarence M. Clark, vice-president, and George E. Hardy, secretary and treasurer. The company has issued $4,250,000 6 per cent cumulative preferred and $6,000,000 common stock and $4,000,000 5 per cent collateral trust gold bonds, due July 21, 1939. The company was organized with a cash surplus of $500,000 without a floating indebtedness. Included in this organization are the Peoria Light Company, capitalized and outstanding, $3,500,000; bonded debt, $3,500,000; the Evansville Light Company, capitalized at $3,000,000, outstanding $2,500,000, no bonds; the Springfield (Ill.) Railway & Light Company, capitalized at and outstanding, $3,000,000; bonded debt, $2,750,000; and the Rockford & Interurban Railway Company, capitalized at and outstanding, $1,050,000; bonded debt, $1,725,000, the last company being a recent acquisition. These companies operate street railways and interurban lines, gas, electric, power and heating properties in Springfield, Peoria, Rockford, Freeport and Belvidere, Ill.; Beloit and Janesville, Wis., and Evansville, Ind., and serve a total population of 300,000.

ALBANY & HUDSON RAILROAD.—The 37-mile third-rail line of the Albany & Hudson Railroad connecting these two places is now in the hands of its general manager, Mr. R. H. Smith, who has been appointed receiver on application of the Trust Company of America, as trustee under the first mortgage on the property. The receivership proceedings are declared to be a part of a general scheme at extensions of the road, which is a third-track electric line, directly from Albany to Pittsfield. It is proposed to reorganize the company, and ex-Governor Myron T. Herrick of Ohio, Clinton L. Rossiter, vice-president of the Long Island Loan & Trust Company, and R. A. C. Smith, president of the American Mail & Steamship Company, have been named as a reorganization committee for the purpose of establishing the road on a profitable basis. It is said that the reorganized company will also buy the Albany & Greenbush Bridge, which is considered necessary to the completion of any across-the-State system of electric lines which could compete effectively in the future with the steam railroads.

ADDITIONAL BELL TELEPHONE MERGERS.—In addition to acquiring the stock of the New York & New Jersey Telephone Company and the Philadelphia Bell Telephone Company, The American Telephone & Telegraph Company has arranged to obtain possession of the affiliated companies in Buffalo and Pittsburgh. The offer to the stockholders of the Bell Telephone Company of Buffalo is on the basis of one share of American for one and one-half shares of Buffalo Bell. By a deal which it is said will involve about $13,000,000, the American Company has taken over the Central District & Printing Telegraph Company, which operates all of the Bell lines in Western Pennsylvania, Eastern Ohio, and a part of West Virginia—that is, the district centering around Pittsburgh. The exchange is being made on the basis of one share of American for one and one-half shares of the Central.

BANKRUPTCY OF XENIA (O.) LIGHT COMPANY.—The Cincinnati Federal Court has issued an order in the case of the People's Gas & Electric Light Company of Xenia, Ohio, to the effect that failing payment of the principal and interest on the bonds issued in 1902, amounting in all to $195,119.15, the property shall be sold as a unit from the courthouse steps in Xenia, after it has been duly advertised for four weeks. The electric lighting plant is in operation, but the gas plant is now idle. The upset price on the property has been fixed at $20,000. Bidders will be required to deposit certified checks for $2,000 as an evidence of good faith. After the expenses of the receivership have been paid, the proceeds of the sale are to be distributed among the bondholders pro rata.

BELL TELEPHONE MERGER.—In connection with the unanimous vote of the directors of the Central District & Printing Telegraph Company to accept the offer of the American Telephone & Telegraph Company to exchange the stock of the latter for the former, as noted elsewhere in this issue, Mr. M. H. Buehler, general manager of the Bell Telephone Company for Pittsburgh, said: "This is the fourth deal in a movement which will eventually extend over the entire country. The local deal has been pending for some time, and is but a part of a movement on the part of the American Telephone & Telegraph Company to consolidate all the Bell companies in the United States under one head."

SALE OF WESTCHESTER ROAD.—H. R. Barrett, of White Plains, N. Y., has been appointed referee to sell the Tarrytown, White Plains & Mamaroneck Railway Company at foreclosure. The application for the sale was made by the Knickerbocker Trust Company, trustee for the bondholders, to whom the company owes about $300,000. It is now in the hands of J. Addison Young, of New Rochelle, the receiver, who recently purchased 25 "pay-as-you-enter" cars and made other improvements in the effort to make the road meet expenses. It is expected that the road will be sold from the steps of the White Plains courthouse in September or October.

McCALL FERRY COMPANY CONTRACTS.—Since the receivership of the McCall Ferry Power Company there has been some question as to the possible effect on the contracts held in Baltimore for distribution of power. The Consolidated Gas, Electric Light & Power Company holds a contract for the distribution of this power within a radius of 25 miles from the Washington Monument, while the United Railways Company also holds a contract to use this power for its own purposes in Baltimore. This gave to the two companies a practical monopoly. If the reorganization should result in a new company, the question is whether the existing contracts will hold good. The Consolidated Electric Company had large projects in view as soon as this power was available. It was expected to increase the power consumption by large manufacturing plants which have heretofore used steam as the chief motive power. The rates, it is understood, would have been so low as to preclude the installation of isolated plants by large manufacturers. J. Edward Aldred, the receiver named in Pennsylvania, has been appointed by Judge Morris for the property in Maryland. It is understood that the receivership will not interfere with its completion of the work and money will be raised by the issuance of certificates. Word has been received from Washington that the bureau of corporations is investigating the troubles of the McCall company. Mr. Aldred's bond has been fixed at $20,000.

THE B. F. STURTEVANT COMPANY REORGANIZED.—The B. F. Sturtevant Company has been reorganized and its capital increased from $500,000 to $1,250,000 6 per cent cumulative preferred stock and $1,250,000 common stock. The new stock has all been taken by a few of the large owners. John Carr, chairman of the board of directors of the First National Bank, Boston, is president, Eugene N. Foss is treasurer, and E. B. Freeman has been elected general manager. The increased capitalization represents capital expenditures during the past year, largely in the erection of a new plant in Hyde Park which cost over $1,500,000. The B. F. Sturtevant Company has been doing a business of about $3,000,000 a year. Its fan and blower output has increased at such a rate that it was necessary to enlarge the capital to handle the business. Still further additions to the plant will be made next spring.

WESTINGHOUSE ELECTRIC REPORT.—As noted elsewhere in this issue, the Westinghouse Electric & Manufacturing Company has issued a report for the year ended March 31, 1909. It showed the year's gross earnings to have been $20,606,000, as against expenses and other deductions of $21,525,000, there being a resultant deficit of $919,000. There was a decrease in the surplus account during the year of $2,992,000, due to loss from operations of the business; to allowances for depreciation; to expenses incurred in connection with the adjustment of the debt which existed on Oct. 23, 1907, when the company went into receivers' hands; to compensation and expenses of receivers and their attorneys; to sundry amounts charged off to reduce book value of company's assets; to depreciation of patents; depreciation of various stocks and bonds; provision for possible losses on inactive finished parts and machines on hand at the close of the year, and other minor items of similar nature. Mr. George Westinghouse in his presidential report to the stockholders says: "While there has been a decided improvement in the business of the company since the beginning of the year, it has not yet nearly reached normal proportions, although the outlook and inquiries indicate that in the near future the full capacity of your works will be required to meet the demand."

TO TAKE UP MARYLAND TELEPHONE BONDS.—A notice has been issued by Nicholas P. Bond, president of the Baltimore Electric Company, for the redemption of general mortgage bonds of the Maryland Telephone & Telegraph Company, secured by a mortgage from the above company to the Central Trust Company, of Baltimore, dated March 2, 1903. The bonds are to be redeemed and paid off at the next interest date September, 1909, at the office of the trustee, by the payment of interest and principal, with a premium of 5 per cent.

PLYMOUTH COUNTY (MASS.) GAS LIGHT & POWER COMPANY.—A petition has been presented to the Massachusetts Gas and Electric Light Commission, by the Plymouth County Gas, Light & Power Company for permission to issue $600,000 capital stock and $400,000 of 5 per cent bonds. The company has recently been organized for the manufacture and sale of gas.

RIVAL TO BELL TELEPHONE.—The National Telephone & Telegraph Company, which has been incorporated at Harrisburg, Pa., with a nominal capital of $10,000, is said to be the parent of a big corporation intended for national competition with the American Telephone & Telegraph Company. The charter includes every county of Pennsylvania, every State and Territory and Alaska.

TRACTION AND LIGHT PROPERTIES FOR PENNSYLVANIA RAILROAD.—It is reported that interests friendly to the Pennsylvania Railroad are about to take over holdings which control all of the traction and electric light properties between Steubenville, Ohio, and Beaver, Pa.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Montreal Street Railway Company:					
June, 1909	$354,918	$190,320	$164,598	$48,134	$116,464
June, 1908	331,212	166,083	165,128	48,992	116,136
Rutland Railway Light & Power Company:					
Year ending June 30, 1909	249,658	131,692	117,966	81,396	36,570
Year ending June 30, 1908	254,807	140,444	114,363	.....	.....
Aurora, Elgin & Chicago Railway Company:					
June, 1909	142,568	71,332	71,236	28,982	42,254
June, 1908	125,592	62,698	62,894	27,843	35,051
Cumberland Telephone & Telegraph Company:					
June, 1909	536,985	302,279	234,705	41,540	193,165
June, 1908	504,364	292,209	212,155	35,374	176,781
Chicago Railways Company:					
May, 1909	1,055,160	709,744	345,416	.....	.....
May, 1908	902,482	600,352	302,129	.....	.....
Detroit Street Railway Company:					
June, 1909	698,485	423,826	274,659	156,997	129,833
June, 1908	635,792	384,191	251,601	137,179	119,087
Kansas City Home Telephone Company:					
Year ended March 31, 1909	819,786	413,535	406,251	150,260	255,991
Year ended March 31, 1908	766,946	412,971	353,975	150,102	203,873
Kings County (N. Y.) Electric Light & Power Company:					
Six months ended June 30, 1909	1,839,765	874,878	964,887	519,706	450,181
Six months ended June 30, 1908	1,776,723	824,660	952,063	498,278	453,785
Lexington (Ky.) Interurban Railways Company:					
May, 1909	49,907	33,463	16,444	.....	.....
May, 1908	49,149	35,727	13,422	.....	.....
Twin City Rapid Transit Company:					
June, 1909	593,101	260,881	332,220	140,251	191,969
June, 1908	553,500	270,018	283,482	128,250	155,232
United Railways of St. Louis:					
June, 1909	964,024	600,617	380,407	232,322	131,085
June, 1908	915,339	572,259	343,080	230,883	112,247
Virginia Passenger & Power Company:					
May, 1909	178,350	101,320	77,030	.....	.....
May, 1908	167,383	108,667	58,716	.....	.....
Rio de Janeiro Tramway Light & Power Company:					
Year ending Dec. 31, 1908	7,138,247	4,407,813	2,730,434	1,860,198	870,236
Year ending Dec. 31, 1907	6,303,706	4,183,385	2,120,321	.....	.....
Northern Ohio Traction & Light Company:					
June, 1909	198,203	107,979	90,227	44,245	45,982
June, 1908	174,444	98,895	75,549	44,120	31,429
Toledo Railways & Light Company:					
June, 1909	216,156	129,075	87,081	70,917	16,164
June, 1908	201,766	107,458	94,308	71,762	22,546

GENERAL NEWS

Construction News.

ALBERTSVILLE, ALA.—Reports are current that it is the intention of the Sand Mountain Electric Company to develop water power on Short Creek and extend its transmission lines to Boaz, five miles distant. Definite details will probably be available later. E. O. McCord is president and general manager of the company.

BIRMINGHAM, ALA.—Newspaper reports state that Mayor O'Brien will recommend to the City Council the installation of an electric light plant.

CULLMAN, ALA.—It is the intention of the Municipal Electric Light Plant to install another 105-kw dynamo, to extend its transmission lines and to replace its 250-hp Erie City engine with a Corliss engine. B. Kiel is superintendent of the company.

NEW DECATUR, ALA.—The terms of the new contract entered into between the Decatur Light, Power & Fuel Company and New Decatur for furnishing lighting for the city are as follows: Thirty arc street lamps, the distribution of which is to be directed by the street committee, are to be supplied by the lighting company at a cost to the city of $2,250 a year. Provision is also made that if the company fails to give proper service the contract may be annulled.

YORK, ALA.—Work is soon to be commenced by the Southern Bell Telephone & Telegraph Company on the construction of a line between this city and Demopolis. Plans are also being considered for the erection of a line to Millville.

WHIPPLE BARRACKS, ARIZ.—Bids will be received until Aug. 2 by J. W. Pope, Ch. Q., M. U. S. A., Denver, Col, for furnishing electric energy at Whipple Barracks for lighting and small motor purposes. The distributing system will be ready about Jan. 1, 1910.

ELDORADO, ARK.—The Eldorado Light & Water Company, so we are advised by W. H. Holmes, vice president and general manager of the company, is doubling the capacity of its plant, and installing a 250-kw, 60-cycle unit.

HELENA, ARK.—The plant of the Southwestern Telegraph & Telephone Company at this city is being entirely rebuilt.

JONESBORO, ARK.—The Home Telephone Company of this city has applied for a franchise in Paragould, it being its purpose to at once commence work on the installation of an up-to-date exchange and telephone system as soon as favorable action on its application has been taken by the City Council.

OSCEOLA, ARK.—We are advised by Abner Driver, owner of the electric light plant at this city, that he contemplates the installation of a 30-kw, alternating-current, 60-cycle, 2200-volt machine for day service.

BAKERSFIELD, CAL.—The West Side Electric Company has requested the Board of Supervisors to advertise for sale a franchise for the stringing of wires for the transmission of electricity to cover the West Side oil fields from Sunset to McKittrick. According to the terms of the advertisement, bids will be received up to Aug. 7, and the successful bidder must commence work within four months after the franchise is granted.

HAMILTON CITY, CAL.—The Northern California Power Company is constructing a power house at this city, and erecting transmission lines between Nord and Hamilton City.

KEELER, CAL.—Plans are being considered by the Four Metals Company for the installation of a power plant to operate its smelter at this city. Definite action, however, will not be taken until the proposition of the Nevada-California Power Company to supply energy to the smelter has been duly considered, the latter company agreeing to supply electricity as cheaply as the Four Metals Company can generate it. Should the Nevada company's offer be accepted, it will at once commence construction work on a 70-mile transmission line from Bishop to Keeler, which will give service to Lone Pine, Big Pine and a number of towns in that vicinity.

LOS ANGELES, CAL.—It is reported that steps toward the establishment of an electric light plant in this city have been taken, the City Council having approved a recommendation of the Board of Public Works that $10,000 be set aside from general taxes for the next two years to pay the cost of preliminary work of establishing power plants along the line of aqueduct.

LOS GATOS, CAL.—It is stated that the Board of Supervisors has awarded to the Los Gatos Ice, Gas & Electric Company a franchise to construct and operate a line of poles and wires for an electric light and power system in Santa Clara County for a period of 50 years, it being the company's intention to give service to practically all of the towns between Los Gatos and Palo Alto. J. D. Farwell is manager of the company.

NEVADA CITY, CAL.—Application has been made to Supervisor Bigelow, of the national forest, by C. C. Curtis, engineer of the Southern Pacific Company, for permission to construct a power plant on the North Yuba river, in Sierra county.

NEVADA CITY, CAL.—It is understood that a well-financed Eastern company has become interested in the Yellow Metal Mine near Bowman's Dam, and that arrangements are being made for the erection of a 10-stamp mill which is to be operated by electric motors.

OAKLAND, CAL.—An ordinance has been introduced in the City Council requiring all wires between Oak and Grove Streets and First and Twentieth Streets to be placed under ground within the next four years. In the ordinance this general district is divided into four smaller ones, underground work in one of which is to be completed each year.

OAKLAND, CAL.—News comes from this city that the Board of Public Works has granted permission to the Great Western Power Company to erect transmission lines from Trestle Glen to its plant at Sessions Bason. This concession by the Board of Works is taken as an indication that the franchise now before the City Council for permission to install overhead and underground wires will soon be granted to the Great Western Company.

PACIFIC GROVE, CAL.—The Monterey County Gas & Electric Company is rebuilding its alternating-current distribution system to meet the rapid growth of the town, and to make the line construction conform to the company's modern specifications. On account of operating conditions, this work is being done a small section at a time. The entire work will cover about nine months, at an estimated cost of $10,000. Mr. F. J. Sutherland is assistant general manager.

REDDING, CAL.—The Sacramento Valley Power Company, which is reported to be a consolidation of the Northern Light & Power Company and the Shasta Power Company, is planning to extend its transmission lines south as far as Chico.

SANTA ROSA, CAL.—A franchise has been granted by the City Council to the Sonoma & Lake County Railroad to construct an electric railway in Santa Rosa. The company's plans include the erection of a line to connect Cloverdale, Preston and Lakeport. A. E. Dickinson, Ukiah, is president.

VALLEJO, CAL.—Newspaper reports state that the Vallejo Electric Light & Power Company, of which K. Casper is general manager, is considering the extension of its transmission lines into the Heights section of the city.

WILMINGTON, CAL.—The board of trustees has granted to the Pacific Electric Railway a 50-year franchise to construct an electric railway on certain streets of Wilmington.

COLORADO SPRINGS, COL.—Credence is given to the reports that the Manitou Electric Company will soon pass into the hands of the Pike's Peak Hydro-Electric Company, the consideration involved in the transfer, it is understood, being about $25,000. It is stated that stock in the Hydro-Electric Company will be offered to the owners of the Manitou company.

DENVER, COLO.—Press reports state that the Greeley-Fouche Irrigation Company, of which D. A. Canfield is president, and the Denver Tramway Company, J. A. Beeler, Denver, president, will soon let contracts for the power plant and irrigation system in northern Colorado. The plans include the enlarging of the Roosevelt reservoir by building a dam 400 ft. high and the construction of transmission lines to conduct the energy to Denver.

GROVER, COLO.—The Grover Telephone Company contemplates the erection of a telephone line from Grover to Cheyenne, via Hartford, Carpenter and Camp Stool.

PALISADES, COL.—The Palisades Light, Heat & Power Company contemplates the erection of ten miles of transmission line. H. L. Davis is manager.

PUTNAM, CONN.—We are advised by the Putnam Light & Power Company, of which R. E. Thurston is general manager, that it has extended its transmission lines from French River to Thompson, and that it is installing 30 32-cp series lamps for street lighting in Pomfret. Mr. Thurston also states that the French River Textile Company, at Mechanicsville, is installing a 150-kw generator to furnish water-power to the Putnam Light & Power Company.

WILLIMANTIC, CONN.—The organization of the Rockville & Willimantic Lighting Company, which has taken over all of the charter rights of the Willimantic & Stafford Springs Street Railway Company, has been completed, and the following officers have been elected: President, Walter Learned, New London; vice-president, H. C. Murray, Willimantic; secretary, treasurer and general manager, A. J. Campbell, New London. The new concern will not attempt to utilize the street railway rights for the present, but will furnish electricity to Willimantic, Rockville, Stafford Springs and a number of towns in Windham and Tolland counties. It is capitalized at $700,000.

JACKSONVILLE, FLA.—The Electric Committee of this city has submitted specifications showing the cost of the addition of 100 new arc lights to the city's circuits to be about $9,054, and has recommended their installation.

LEESBURG, FLA.—A thirty-year franchise for the construction of an electric plant has been granted by the City Council to J. Y. Clark, so it is stated.

MULBERRY, FLA.—The Mulberry Electric Company, so we are informed by R. H. Pratt, president of the company, contemplates the extension of its transmission lines to Kingsford.

ADAIRSVILLE, GA.—It is currently reported that the city is considering the installation of an electric light system. Address the Mayor.

ELLIJAY, GA.—A company, to be known as the Coosawattee & Mountaintown Power Company, of Ellijay, is reported to have been incorporated by W. M. Scott, of Atlanta, and E. W. Watkins & Sons, of Ellijay, for the purpose of constructing a hydro-electric plant, mention of which was made in our issue of July 15. Hall Bros., of Atlanta, have had the surveying in charge, and it is estimated that at least 5000 hp will be developed along the Coosawattee and Mountaintown rivers.

SAVANNAH, GA.—The Savannah Electric Company, of which M. L. Sperry is general manager, is installing a 100-kw Allis-Chalmers alternating-current turbine.

LEWISTON, IDAHO.—The Nez Perces Co-operative Telephone Company is rebuilding its line between this city and Grangeville.

MEADOWS, IDAHO.—A new power plant is being erected on the Little Salmon River by Chisholm & Goodman, of this city.

ST. MARIES, IDAHO.—Permission to install and maintain an electric lighting system in this city has been granted by the Board of Village Trustees to G. H. Jay, of Great Falls, Montana, the other applicants for the franchise being the Washington Water Power Company and C. A. Cochran. It is understood that work is to be commenced at once by Mr. Jay on a $50,000 hydro-electric plant, and that a lighting service from same will be in operation within six months.

SALMON, IDAHO.—The Andrews Light & Power Company, of Salmon, Idaho, which in February purchased the interests of Quarles & Quarles and the Salmon Electric Company, has placed its new station in operation. The equipment consists of a 600-hp water wheel, direct-connected to a 200-kw, 2300-volt, three-phase generator built by the Allis-Chalmers Company. A seven-mile transmission line furnishes 100 hp to the mines of the Copper Queen Mining & Smelting Company. The transmission tension is 11,000 volts stepped down to 440 volts for motor circuits and 110 volts for lamp circuits. The company contemplates the installation of a second larger unit similar to that just put in operation next year.

BEMENT, ILL.—Newspaper reports intimate that the Board of Trustees of this city are considering the installation of a municipal lighting plant.

BURNT PRAIRIE, ILL.—It is officially announced that the Carmi-Fairfield Traction Company, which is not yet chartered, will commence construction work early in September on an electric railway connecting Carmi, Sumpton, Liberty and Fairfield, a distance of about 25 miles. The power station is to be located at Burnt Prairie, and it is the company's intention to furnish energy for lighting also. E. S. Lawrence, St. Louis, Mo., is chief engineer.

CLINTON, ILL.—The National Telephone & Electric Company, which has recently purchased from the Kinloch-Bloomington Company its trunk line between Clinton and the north boundary of DeWitt county, and a line from Farmer City half way to Leroy, expects to rebuild the lines at once.

MACOMB, ILL.—The extensions planned by the Illinois Western Telephone Company in its system include the construction of a line from this city to Galesburg, via Bushnell, and one to Peoria, via Canton.

PEORIA, ILL.—The Railway Terminal Company is considering the purchase of two units and three boilers for its power station.

YORKVILLE, ILL.—It is stated by Hugh Palmer, president and chief engineer of the Yorkville & Morris Railroad, that the company is to be reorganized and work resumed on its proposed electric railway connecting Yorkville, Lisbon and Morris, a distance of 22 miles. The line will later be extended to Ottawa.

HOPE, IND.—The Hope Independent telephone plant, and the plant at Hartsville, recently sold to J. W. Aspy, Joseph Burney and others, will be remodeled and new equipment installed. It is understood that connections have been established with the Bell company at Columbus, but it is claimed that a merger with that company has not been effected.

DES MOINES, IA.—Through a recently consummated deal, the Des Moines Electric Company has passed into the hands of the Illinois Traction Company, the consideration being in the neighborhood of $1,000,000. The purchase will give the McKinley system entrance into a valuable interurban territory in Iowa, and will make a line from Peoria to Des Moines a possibility of the near future.

EARLHAM, IA.—We are advised by J. R. Thomson, Mayor of the Town of Earlham, that bids will be received for the construction of water and light plants up to Aug. 2, 12 o'clock noon. Plans are on file at the Mayor's office and at the Des Moines Bridge & Iron Works, Des Moines, Ia.

WHITESBURG, KY.—The establishment of an electric light plant at this city is being promoted by David C. Mullins.

COLUMBIA, LA.—A new exchange and up-to-date telephone system is being installed in this city by the Home Telephone Company, of Monroe.

ELLSWORTH, ME.—It is stated that Engineer J. A. Leonard, of the Bar Harbor & Union River Power Company, has been working on plans for doubling the equipment of the company's power plant at Ellsworth. The present equipment produces 1500-kw, there being two generators of 1000 kw and 500 kw, respectively, and it is proposed to install two new generators which will add 2000 kw to the rating of the plant.

BOSTON, MASS.—Bids will be received until Aug. 20 by Col. Edward Burr, Corps U. S. A., for electrical cable.

HAVERHILL, MASS.—During a recent electrical storm at this city one of the large power dynamos of the Haverhill Electric Company was burned out, crippling all plants depending on electric power.

HOLYOKE, MASS.—We are informed by the Board of Public Works that the item printed in these columns stating that the board is contemplating the expenditure of $50,000 for the enlargement of the electric lighting plant, etc., is incorrect, inasmuch as the board has not the control of the lighting plant in that city, and that so far as it knows no such amount of money is to be expended.

NEW BEDFORD, MASS.—The contract for lighting the new Registry of Deeds Building in this city has been awarded by the county commissioners to Robert D. Ireland & Co., of Boston, for $5,598.

ORANGE, MASS.—The Orange Electric Light Company expects to commence work at once on the improvements planned at Wendell Depot and the immediate vicinity, which include the construction of a large dam and power house at Wendell Depot as well as the construction of two or more dams in Warwick.

PALMER, MASS.—The Central Massachusetts Electric Company has been granted additional pole locations in Thorndike, Three Rivers and in Palmer Center.

PITTSFIELD, MASS.—One of the dynamos in the power house of the Pittsfield street railway was burned out during a recent electrical storm at this city.

SALEM, MASS.—A committee to investigate rates for street lighting has been appointed by the city of Salem, its contract with the local electric light company having expired this spring.

SOUTHBRIDGE, MASS.—A temporary contract with the Webster & Southbridge Gas & Electric Company has been signed by the selectmen of this city. The contract provides for a reduction in rates and the substitution of tungsten lamps for the present arc lights as fast as the latter need renewing. While the contract calls for a term of five years at the prescribed rates, it is understood that it is subject to alterations by the selectmen.

IRONWOOD, MICH.—Application has been made to the City Council by the Twin City Railway Company for a franchise to extend its lines to Bessemer.

MUSKEGON, MICH.—Information comes from this city that the Interurban Electric Light & Power Company, which has construction rights across Mason and Oscead counties from Hamlin Lake to Shelby and which was organized to furnish electricity to Ludington, Pentwater, Hart, Shelby and smaller places along the right of way, has almost completed work on the lower dam at Hamlin Lake. Wires are being strung from Ludington to Pentwater and arrangements are being made to take over the Pentwater lighting plant. Power rights on the Pere Marquette River capable of developing 30,000 hp are said to have been secured.

ANOKA, MINN.—About $5,000 is to be expended by the Northwestern Telephone Exchange Company in the improvements it intends to make in this city.

BAUDETTE, MINN.—Bids will be received by the Village Clerk until Aug. 6 for the construction of water-works and an electric light plant. Mr. C. R. Middleton is Village Attorney.

MERIDIAN, MISS.—It is currently reported that the Meridian Light & Railway Company, of which A. B. Paterson is general manager, expects to erect an addition to its power house, in which will be installed a 1500-hp engine and a 1000-kw generator. J. N. Eley is credited with being the consulting electrical and mechanical engineer.

KANSAS CITY, MO.—It is reported that the People's Ice Company will rebuild its power house, which was destroyed by fire.

SEDALIA, MO.—The following bid for furnishing lights in the city of Sedalia for the next ten years has been submitted by the Sedalia Light & Traction Company. The company will furnish 150 arc lights, 26 more than are now in use, for $60 per light for one year. Ten cents per kw for residence lights, eight cents per kw business lights and five cents per kw for power were other bids.

SPRINGFIELD, MO.—The citizens are reported to have voted in favor of extending the franchise of the Springfield Gas & Electric Company.

BEAR CREEK, MONT.—Application for a franchise to construct an electric light and water plant at this city has been made, so it is reported, by Chris Yergen.

HAMILTON, MONT.—A statement to the effect that the electric light plant at this city will be entirely remodeled and made modern in every particular is, according to press reports, credited to W. O. Fisk, of Hamilton.

MOORE, MONT.—An electric light franchise, a duplicate of that voted by the City of Lewistown, has been granted to S. W. Gebo, who controls the Lewistown Coal, Gas & Light Company. It is stated that

work on the construction of the company's transmission lines from Lewistown, at which place it has temporary offices in the Bank of Fergus County building, to Moore will be commenced at once, and that a 24-hour service will be operative at an early date.

ROUNDUP, MONTANA.—It is reported that James U. Gridley has made application for an electric light franchise in this city.

HASTINGS, NEB.—Arrangements are being made for the enlargement of the municipal electric light plant at this city.

SWEETWATER, NEV.—It is reported that P. J. Conway has disposed of his ranch and power holdings in this city to Judge Costigan and Dr. Pollard, who, it is understood, represent the Walker River Electric Company. Plans are being prepared by the new owners for the construction of a large power plant, which will supply power to Masonic, Bodie, Aurora and Lucky Boy.

MILTON, N. H.—Work on the construction of a dam across the Salmon Falls River, near the Flume, has been commenced by the Great Falls Manufacturing Company, and it is reported that the company will install an electric plant at that point in the near future.

CRANFORD, N. J.—It is announced that C. Z. Smith, township committeeman, is interested in the establishment of a municipal electric light plant at this city.

FLEMINGTON, N. J.—The subject of a new lighting contract for Flemington is being considered by the Board of Village Trustees, the present one expiring January 1, 1910. It is understood that propositions have been submitted by the Flemington Electric Light, Heat & Power Company and the Flemington Gas Company, and that the new contract contemplates an all-night service in place of the present one, which is operative only until midnight.

IRVINGTON, N. J.—No bids having been received by the Irvington Council for lighting the streets in response to proposals advertised in the regular manner, Mayor Glorieux has suggested that the Lighting Committee be authorized to readvertise, and a motion was passed to that effect.

SANTA FE, N. M.—It is reported that the application of O. M. Lee and J. L. Lawson, of Alamagordo, to appropriate water from the Rio Ruidoso and tributaries on the Mescalero reservation to develop 5000 hp for electric lighting and other purposes in Fort Stanton and other points has been approved in a modified form by Territorial Engineer Sullivan.

ALBEMARLE, N. Y.—Newspaper reports state that the city will vote July 27 on an issuance of bonds a portion of the proceeds of which are to be used for the establishment of an electric light plant. Address the Mayor.

BALDWINSVILLE, N. Y.—At a recent election held in this city favorable action was taken on the proposition to increase the number of arc lamps in use for lighting the city streets from 24 to 65.

BATAVIA, N. Y.—It is understood that the East Batavia Improvement Association will at once ask for estimates and plans for the proposed lighting system, as well as for material and work.

FRANKLIN, N. Y.—The Delaware & Otsego Light & Power Company, of which E. A. Mackey is president and general manager, advises that it contemplates the extension of its transmission lines to Sidney Center for the purpose of furnishing a lighting service at that place.

FULTON, N. Y.—Arrangements have been made by the Fulton Light, Heat & Power Company with the Syracuse, Lake Shore & Northern Railway Company for the purchase of 250 hp from the latter company, in order that there may be no interruption to the Fulton Company's service during the low-water period.

GOUVERNEUR, N. Y.—Press reports state that the Village Trustees will receive bids until Aug. 3 for lighting the streets. The contract held by the Oswegatchie Light & Power Company expires in September.

NEW YORK, N. Y.—The North Shore Traction Company, it is reported, contemplates the erection of a new power house on the McKnight Realty Company's property at the head of Little Neck Bay on Broadway.

POUGHKEEPSIE, N. Y.—It is estimated that about $250,000 will be expended by the Poughkeepsie Light, Heat & Power Company in the improvements which it proposes to make in its plant, and which include the installation of a new 2000-kw steam turbine generator, new exciter set, condenser, boilers, furnaces and auxiliary apparatus. Arrangements have recently been entered into between this company and the Newburgh Light, Heat & Power Company for supplying the latter company with additional electrical energy.

ROME, N. Y.—It is the intention of James S. Brailey and E. L. Cline, of Toledo, the new owners of the Rome Home Telephone Company, to reconstruuct the entire system.

SYRACUSE, N. Y.—It is the intention of the Syracuse Lighting Company, now that it has been authorized by the Public Service Commission to execute an extension and improvement mortgage, and to issue $143,000 for proposed new work this year, to at once commence the installation of additional street lamps in Syracuse. It is stated that 71 new lamps are to be put into service.

CONCORD, N. C.—A franchise to construct electric railway lines in this city has been granted to the Piedmont Carolina Railway. It is stated that the system will also be extended to several nearby towns.

DUNN, N. C.—It is reported that the capacity of the local electric light plant at this city is being doubled by the installation of a new boiler and other machinery.

KINGSTON, N. C.—The date on which a vote will be taken for the issuance of $50,000 of bonds, the proceeds to be used for extending the water and light system, has been set for August 24. W. D. La Roque is Mayor of the city.

THOMASVILLE, N. C.—Energy to operate the Glen Anna Milling Company's plant is to be supplied by the Thomasville Light & Power Company, which intends to install a transmission station on the line recently constructed to Cedar Lodge for the purpose of furnishing electricity for lighting and agricultural purposes at that point.

WADESBORO, N. C.—Plans are reported under way for the construction of a hydro-electric plant at Kendall Ferry, on Rocky River, about 15 miles north of Wadesboro, which will supply power for a number of industrial enterprises. A. H. Richardson, of Ansonville, N. C., and other leading men of Anson County are interested in the project, and are now engaged in securing the necessary options and requisite funds to carry out every detail of their plans. It is estimated that the probable cost of the plant, which is expected to develop between 6000 and 7000 hp, will be about $400,000.

WILSON, N. C.—The Wilson electric light plant is making extensive improvements, including the installation of a new Murray Corliss 450-hp engine.

GRAND FORKS, N. D.—W. H. Alexander, City Auditor, writes that bids will be received about Aug. 9 for the construction of an electric light plant, probable cost $30,000. Engineer, Earle D. Jackson, St. Paul, Minn.

COLUMBUS, OHIO.—Four new branch exchange buildings, the estimated cost of which is $150,000, are to be erected by the Columbus Citizens' Telephone Company.

COLUMBUS, OHIO.—Bids will be received until Aug. 18 by the Board of County Commissioners (John Scott, clerk) for furnishing and installing a complete electrical lighting equipment for the county jail, including all lighting fixtures, electric lamps, conduits, wires, etc.

DEFIANCE, OHIO.—The Northwestern Telephone Company has increased its capital stock from $60,000 to $100,000, and proposes to make improvements in its system.

FAYETTE, OHIO.—It is currently reported that the citizens have voted to issue bonds for the installation of an electric light plant. C. D. Hause is the village clerk.

TOLEDO, OHIO.—The Citizens' Lighting & Heating Company has applied for permission to install underground conduits for the transmission of electricity for light and power purposes in a number of additional streets in Toledo.

HYDRO, OKLA.—It is understood that an election is soon to be held in this city for the purpose of voting on a proposition to issue $25,000 of bonds for water works and an electric light system.

MEDFORD, OKLA.—The City Clerk writes that the city may install an electric light plant, but that nothing definite has as yet been done.

EUGENE, ORE.—It has been decided by the City Council to leave the details of the construction of the city power plant in the hands of a committee of four, consisting of Mayor J. D. Matlock and the committee on fire and water.

JACKSONVILLE, ORE.—A franchise has been granted to the Jackson County Electric Light & Power Company to erect pole lines for the transmission of power and light in this city.

PITTSBURGH, PA.—A new power plant is to be installed at its Aliquippa works by the Jones & Laughlin Steel Company, of Pittsburgh, so it is reported, the additional power to be used exclusively for the operation of a new tin plate plant now being built, and which will have an equipment of 30 tin mills.

READING, PA.—The Metropolitan Electric Company has submitted the following bids for the street lighting of Reading: On a five-year basis: 700 magnetite arc, 320-watt lamps, $76.00 per annum; 500 tungsten incandescent, $19.20 per annum. On a 10-year basis: 700 magnetite arc, 320-watt lamps, $65 per annum, and 500 incandescent tungsten, 75 watts, $19.20 per annum. Lighting public buildings, 12 cents per kw-hour, net, on a five-year basis; on a 10-year basis, 6 cents per kw-hour, net. As showing the comparative costs of electric and gas lighting, it may be interesting to note that the Consumers' Gas Company offered to furnish 500 Welsbach mantle lamps, all night and every night, at $25 per lamp per annum.

SCRANTON, PA.—The Scranton Electric Company, so we are advised by L. H. Conklin, contemplates the installation of two 2400-hp Corliss engines and generators at Scranton.

SEWICKLEY, PA.—Bids will be received until Aug. 3 by the light commission for the municipal lighting and the 100 arc lamps to be installed. For further particulars apply to M. M. Baker, borough engineer, 514 Broad Street.

STROUDSBURG, PA.—It is reported that Meikleham & Dinsmore, 25 Broad Street, New York, N. Y., are among those interested in the construction of a hydro-electric plant on the Big Bushkill River, near Stroudsburg. It is stated that while property rights have been acquired, nothing in the way of construction work will be done until fall. The same interests are planning to build a dam across the Susquehanna River

at Towanda, Pa., to develop about 1500 hp in a hydro-electric plant, preliminary surveys having been made.

WILKES-BARRE, PA.—A seven-year contract for lighting the streets of Wilkes-Barre has been entered into with the Wilkes-Barre Gas & Electric Company by the city.

NEWPORT, R. I.—Orders have been issued for extensive improvements in the electric light plant at Fort Adams. The plans call for a new installation throughout, with service mains from the reservation line, which is taken as an indication that electricity from the Newport power station is to be used.

SPARTANSBURG, S. C.—A franchise to enter this city with its power lines has been granted to the Southern Power Company. It is stated that the company, which proposes to establish branch offices at both Spartanburg and Columbia, intends also to extend its transmission lines to Greenville.

YORKVILLE, S. C.—The Piedmont Telephone Company has secured a franchise at this city, and the installation of considerable modern telephone apparatus is contemplated.

GALVESTON, TEX.—W. D. Masterson, city superintendent of electricity, writes that the contract for the new city arc lighting machinery and lamps was awarded by the Board of City Commissioners on July 13 to the Erie City Iron Works for the engine, generator, condenser and other station apparatus; and to the General Electric Company for the lamps and rectifier outfits. The city is replacing the old 9.6 open arcs by the new 4-amp luminous arc of the General Electric Company, and the old simple non-condensing engines for up-to-date station apparatus.

NACOGDOCHES, TEX.—The Nacogdoches Light & Power Company is planning, so we are advised by O. E. Hubbard, secretary and general manager, to change its system from 125 cycles to 60 cycles, and to install new dynamos and engines. It is estimated that the proposed improvements will represent an expenditure of about $20,000.

NORMANGEE, TEX.—Toll lines from this city to North Zulch, Madisonville and Jewett are being erected by the Central Texas Telephone Company, and plans are being considered for the installation of a new exchange at Normangee.

HUNTSVILLE, UTAH.—The city of Huntsville, it is stated, contemplates the installation of a municipal lighting plant, provision having been made by the council for levying a tax to cover the cost of same. It is estimated that the proposed plant, power for which is to be secured from the Ogden River, will cost in the neighborhood of $15,000.

MURRAY, UTAH.—The Progress Company, of which J. P. Cahoos is manager, is reported to be considering the construction of a power plant in the Big Cottonwood Cañyon.

WOODSTOCK, VT.—The Woodstock Electric Company, which has recently acquired W. H. Brownell's interest in the water privileges at Taftsville, as well as the foundry and sawmill properties on the south and north sides of the river, is planning to enlarge its plant at that place. The present dam is to be replaced, and when the contemplated improvements are completed the company expects to be able to furnish a constant day service.

HIGHLAND PARK (P. O. Richmond) VA.—It is reported that the city has decided to issue $50,000 of bonds, the proceeds of a portion of which are to be used for the extension of the electric lighting system. Address the Mayor.

HUSUM, WASH.—The Husum Power Company is constructing a transmission line two miles north of Husum for the purpose of furnishing electricity in that section. J. T. Thompson is manager of the company.

SEATTLE, WASH.—An ordinance has been passed by the City Council authorizing the installation of lamp clusters on First Avenue from Virginia Street to Denny Way.

TENINO, WASH.—The Tenino Light, Power & Water Company is reported to have filed a claim of water right to 100 cu. ft. of water per second at Skookumchuck Falls, southeast of Tenino, for the purpose of furnishing electricity for lighting, heating and power purposes for Lewis and Thurston counties. It is stated that a dam will be constructed and a flume and power house will be built to divert the power to different points.

WAPATO, WASH.—It is understood that the Yakima Valley Power Company, which is constructing a high-tension power line from its plant near Naches City to Kennewick, will apply for a franchise at Wapato, the citizens of that city having expressed a desire for an electric lighting and power service.

BARBOURSVILLE, W. VA.—It is stated that the city is to vote on the issuance of bonds for the construction of an electric light plant. Address the Mayor.

ASHLAND, WIS.—It is stated that the power plant at White River, which furnishes electricity to the city of Ashland and the State fish hatchery near Bayfield, was practically destroyed as the result of a cloudburst.

CASSVILLE, WIS.—The Farmers' Telephone Company, of this city, is perfecting arrangements for the construction of a new telephone line between Cassville and Bloomington, as well as one between Lancaster and Bloomington.

LINDEN, WIS.—The city of Linden is seriously considering a proposition to light its streets and residences by electricity, current to be secured from Mineral Point, seven miles distant. John Harker is the chief promoter of the new enterprise.

RACINE, WIS.—The plant of the Citizens' Telephone Company at this city has been taken over by the Wisconsin Telephone Company.

CHEYENNE, WYO.—The Cheyenne Electric Railway, connecting Cheyenne and Fort Russell, has operated very successfully during the first half of the year from the standpoint of net income. The electricity so far has been furnished by the Northern Colorado Power Company from a motor generator set in its local station.

SHERIDAN, WYO.—J. J. Henry, of Denver, Colo., president of the Southern Colorado Power & Railway Company, is reported to be interested in the construction of a power plant near Sheridan.

LADYSMITH, B. C.—We are advised by N. A. Morrison that the city of Ladysmith has given the tender for the municipal electric light plant to the Westinghouse (Canadian) Company, Ltd., for a complete installation consisting of a 150-kw, 3-phase, 60-cycle, 2200-volt generator, 10-kw exciter, Robb compound engine Tirill regulator, switchboard, boiler, transformers, street lamps, etc. The plant is to be erected under the direction of George M. Turner, city electrical engineer.

VANCOUVER, B. C.—It is the intention of the British Columbia Electric Railway Company to extend its lines to Huntington.

LONDON, ONT., CAN.—The Bell Telephone Company is planning to place its wires in conduits in this city, the cost of such work being estimated at $50,000.

NORTH COBALT, ONT.—The Nipissing Central Railway, which is to build an electric railway connecting Cobalt Port, Cobalt and Haileybury, expects also to furnish electricity for lighting. The company has an authorized capital stock of $1,000,000, and the officers are: J. W. Fitzpatrick, North Cobalt, president; P. L. Utley, Escanaba, Mich., vice-president; Alfred Jones, Haileybury, secretary; R. G. Stack, treasurer, and Clarence B. Henry, North Cobalt, electrical engineer and general engineer.

VERDUN, QUE., CAN.—The council is considering the advisability of negotiating a loan of $150,000, the proceeds to be used for the installation of an electric light plant.

SASKATOON, SASK., CAN.—Bids were opened June 22 by J. H. Truesdale, city clerk, for one 500-kw, 2200-volt, 60-cycle, 150 r.p.m. two-phase generator, exciter and switchboard installed complete, and a 750 hp, 150 r.p.m. vertical Corliss engine, with necessary condensing apparatus, installed complete, and we are informed that the contract has been awarded to the Allis-Chalmers-Bullock Company, of Montreal, Que., for $6,860.

Company Elections.

ROSEVILLE, ILL.—The Roseville Telephone Company has elected the following officers: President, Henry Kirkpatrick; vice president, Allen Adkisson; secretary and treasurer, W. J. McQuiston; manager, Walter Waugh.

CLINTON, IND.—The following officers and directors were elected by the Clinton Electric Light & Power Company at its annual meeting: David McBeth, president; B. H. Morgan, vice-president; H. C. Dies, treasurer; J. W. Robb, secretary and manager; directors, David McBeth, B. H. Morgan, H. C. Dies, Mark E. Nebeker and J. W. Robb.

LEE, MASS.—At its annual meeting the Lee Electric Light Company elected the following officers and directors: President, B. T. Gale; treasurer and manager, Carl Wurtzbach; directors, B. T. Gale, J. L. Kilbon, J. C. Chaffee, Carl Wurtzbach and E. L. Murphy.

MARLBORO, MASS.—The Marlboro Electric Company has elected the following directors for the ensuing year: W. G. Webber, Edward C. Mason, Lombard Williams, M. B. Webber, George C. French, Louis P. Howe and A. B. Webber. W. G. Webber is president of the company and Edward C. Mason, secretary and treasurer.

DUNDEE, N. Y.—The following directors have been elected by the Dundee Telephone Company: A. J. Price, M. M. Price, H. D. Sproul, E. Sproul, S. A. Price and C. A. Gilbert.

RUTLAND, VT.—At the annual meeting of the stockholders of the Rutland Railway, Light & Power Company the following officers and directors were elected: G. Tracey Rogers, president; Leo H. Wise, vice president; C. H. West, secretary and treasurer; directors, G. Tracey Rogers, L. H. Wise, L. W. Baldwin, R. L. Warner, C. H. West, G. T. Chaffee and G. S Haley.

New Industrial Companies.

THE CENTRAL INSULATING COMPANY, of Lafayette, Ind., has been incorporated to manufacture insulating material and insulated wire for electrical equipment. The following directors have been elected: W. H. Converse, Paul Clark and Harold Stoud.

THE DE SCHAUM-HORNELL MOTOR COMPANY, Hornell, N. Y., has filed articles of incorporation, and proposes to manufacture automobiles, motor boats, etc. The incorporators are: W. A. De Schaum, H. J. Hopkins and W. C. Paul, all of Buffalo.

THE GARLOCK AUTO SPECIALTY COMPANY, Palmyra, N. Y., has filed articles of incorporation, and intends to manufacture engines, automobiles, etc. It is capitalized at $10,000, and the incorporators are: Olin J. Garlock, H. E. Whiting, S. D. Van Alstine and others, all of Palmyra.

THE LUITWIELER PUMPING ENGINE COMPANY, Rochester, N. Y., has been incorporated to manufacture engines, automobiles, pumps, etc. It is capitalized at $300,000, and the incorporators are: S. W. Luitwieler, W. C. Smith, J. G. Haap and G. W. Rich, all of Rochester.

THE METZ AUTOMOBILE COMPANY, Paterson, N. J., has been incorporated with a capital stock of $25,000 to manufacture engines, motor boats, automobiles, etc. Among those responsible for its formation are: John M. B. Ward, S. F. Holden, Robert Swinley, D. Vanwinkle and others, of Paterson, and J. E. Forgerson, Stockholm, N. J.

THE NATIONAL ANTI-FRICTION ROLLER BEARING COMPANY, Buffalo, N. Y., capitalized at $250,000, has been incorporated by A. T. Killian, F. D. Tracy, J. De Zielinski, all of Buffalo.

THE NATIONAL ELECTRIC WELDING COMPANY, Hoboken, N. J., electric welders of metals, has filed articles of incorporation. It is capitalized at $150,000, and the incorporators are William Moller, Max Smith and Franz Buckel.

THE ROMA CONSTRUCTION & ENGINEERING COMPANY, New York, N. Y., capitalized at $35,000, has been incorporated by G. Marchesini, 585 Washington Street; G. Capone, 402 East 116th Street, and J. Caggiano, 81 East 125th Street.

THE SAUREE MOTOR TRUCKS COMPANY, West Orange, N. J., has filed articles of incorporation, its purpose being to manufacture motors, engines, etc. It is capitalized at $200,000, and the organizers are: William D. Sargent, West Orange, and George M. Judd and E. H. Fallows, 30 Church Street, New York.

THE SCHENECTADY ELECTRIC CLOCK COMPANY, Schenectady, N. Y., has been incorporated to manufacture electric clocks. It is capitalized at $10,000, and the incorporators are: James R. Dyke, Jr., Charles D. Knight, Frank J. Seabolt and E. C. Hall, all of Schenectady.

THE TWENTIETH CENTURY BATTERY COMPANY, Cold Spring, N. Y., has been incorporated and contemplates the manufacture of batteries, electric or otherwise. It has a capital stock of $1,000, and the incorporators are: N. V. Sloat, Carmel, N. Y.; J. Bennett Southard, Cold Spring, N. Y., and William Hofsiss, 191 Covert Street, Brooklyn, N. Y.

THE U. S. BALL BEARING MFG. COMPANY, 112 Clark Street, Chicago, Ill., has been incorporated with a capital of $50,000, to manufacture ball bearing devices. The incorporators are Fritz Henzelman, Carl Rathbert and John W. Utesch.

THE UNIVERSAL ELECTRIC CLOCK COMPANY, of Chicago, has filed articles of incorporation at Springfield, its purpose being to manufacture and deal in electrical apparatus. It has a capital stock of $6,000, and the incorporators are: J. M. Lenz, William L. Dolman and S. W. Bramley.

THE VICTOR ELECTRICAL CONSTRUCTION COMPANY, Columbus, Ohio, has been incorporated with a capital stock of $10,000 by E. L. Morse, Roston Medberg, J. A. Funk, M. A. Culliman and E. B. Taylor.

New Incorporations.

SUTTER CREEK, CAL.—A reorganization has been effected of the Amador Railroad & Electric Light Company and articles of incorporation filed for a new company which is to be known as the Amador Electric Light & Power Company. The capital stock is placed at $90,000 and the following directors have been elected: W. A. Pharis, Provis; J. McGee, B. C. Clark and F. J. Payne.

FREDERICA, DEL.—Articles of incorporation have been filed by the Frederica Telephone Company of this city. It has an authorized capital stock of $5,000, and the incorporators are: John S. Camper, William F. Hoey and G. W. Spurry, all of Frederica.

WILMINGTON, DEL.—News comes from this city of the incorporation of the Twin Falls Oakley Land & Water Company. It is capitalized at $250,000 and the incorporators are: S. E. Robertson, F. M. Shive and Harry W. Davis, Wilmington.

CHICAGO, ILL.—The Advance Power Company, capitalized at $1,000,000, has filed articles of incorporation, the organizers being: C. H. Wilcox, Oak Park, Ill.; W. L. Barnum, W. L. Barnum, Jr., J. E. Harper and F. C. Rutan, of Chicago, Ill.

DOWNS, ILL.—Articles of incorporation have been filed by the Old Town Telephone Company. It is capitalized at $900, and the incorporators are: R. H. Roadman, John McBarnes and George Meiner.

INDIANAPOLIS, IND.—The Indiana Independent Toll Clearing House has been incorporated with a capital stock of $10,000, its object being to establish, maintain and operate telephone lines and telephone exchanges within the State of Indiana, and to conduct a system of toll clearances. The following directors have been elected: Walter J. Uhl, W. J. Coffey, George W. Beers, J. S. Brailey, Jr., and Nelson Hunter.

LANSING, MICH.—The Detroit, Lansing & Grand Rapids Railway Company, capitalized at $25,000, has been incorporated to construct an electric railway between Detroit, Lansing and Grand Rapids. Among those interested in the proposition are Oliver H. Lau and Henry M. Wallace, Detroit.

TRAVERS CITY, MICH.—News comes from this city that the farmers near Kingsley, in Paradise township, Grand Traverse County, have organized a telephone company to be known as the East Paradise Telephone Company, and elected the following officers: President, Edwin Clark; secretary, Bert Smith; treasurer, V. W. Bancroft.

BELLE PLAINE, MINN.—The Belle Plaine Electric Light & Power Company is reported incorporated. Its capital stock is placed at $15,000 and the incorporators are: C. A. Arndt, St. Paul, and F. L. Rauchwater, South Park.

EASTON, MINN.—The Easton Telephone Company has been incorporated with a capital stock of $1,200 by William Sippel, C. Bachtle, W. A. Cusick, W. C. Aschemer, T. Gaffey and B. M. Armstrong.

MOUND CITY, MO.—The Mound City Light & Ice Company has been incorporated with a capital stock of $25,000 by E. M. Miller, R. W. Neill, T. M. McCoy and others.

JERSEY CITY, N. J.—Incorporation papers have been filed in this city by the Joy Construction Company, which proposes to operate a water power system in the towns of Clinton and Madison, Conn., and elsewhere. It is capitalized at $100,000, and the incorporators are: Moses Joy, 827 Whitney Avenue, New Haven, Conn.; David J. Greene, Milford, Conn.; Theodore E. Smith, 54 Hudson Place, Weehawken, N. J.

HORNELL, N. Y.—The Hornell-Bath Railway Company has been incorporated to construct an electric railway from Hornell to Bath, a distance of about 24 miles. It has an authorized capital stock of $250,000 and the following directors have been elected: Charles Adsit, C. H. Armsted, John M. Finch, of Hornell; J. F. Turk, Hammondsport.

McDONOUGH, N. Y.—The Northern German & Pitcher Telephone Company has been incorporated with a capital stock of $400 by C. Yaw, George Hall, S. Beckwith, all of Cincinnatus, N. Y.

CEDAR POINT, OHIO.—Articles of incorporation have been filed by the Cedar Point Railway, whose purpose is to construct an electric railway along the lake shore to connect the Cedar Point resort with the Lake Shore Electric Railway at Sandusky. It has a capital stock of $10,000 and W. C. Phelps is one of the incorporators.

COLUMBUS, O.—News comes from this city of the incorporation of the Northwestern Traction Company, which contemplates the construction of an electric railway from Newark, via Fallsburg, West Carlisle, Cooperdale and Wakatomika, to Coshocton and New Philadelphia. It has a capital stock of $25,000, and the incorporators are: G. W. Oxley, E. S. Crawford, T. S. Sharpless, S. H. Miller and J. M. Magruder.

ARDMORE, OKLA.—The Arbuckle Power Company is reported organized, and it is understood that a dam is to be constructed on the Washita River, the power from which is to be used in operating a glass factory which the company proposes to build near the hydro-electric plant. It is estimated that the construction of the dam will cost about $140,000.

INOLA, OKLA.—The Inola Telephone Company, of this city, has been chartered. It is capitalized at $2,000, and the incorporators are: J. Cameron, J. E. Hathaway, John H. Ross, A. K. Critchen, all of Inola, and W. A. Crockett, of Choteau.

MEDIA, OKLA.—Articles of incorporation have been filed by the Media Telephone Company. It has an authorized capital stock of $2,400, and those interested are: S. L. Sheets, J. I. Horace, F. M. Gibson, all of Fairbanks.

PENDLETON, ORE.—The Holdman Telephone Company has been organized with a capital stock of $5,000 for the purpose of constructing a telephone line from Pendleton to Holdman, a distance of about 20 miles. The organizers and trustees of the company are: J. A. Crosswell, Robert A. Bissinger, F. L. McCrea and Henry Mills.

HARRISBURG, PA.—The National Telephone & Telegraph Company, capitalized at $10,000, has filed articles of incorporation at this city.

PHILIPSBURG, PA.—The Philipsburg Milling, Lighting & Heating Company, capitalized at $15,000, has filed articles of incorporation, the incorporators being: A. Copelin, Duke Copelin, Philipsburg, Pa., and F. G. Copelin, Kane, Pa.

BEAUMONT, TEX.—Articles of incorporation have been filed by the South Beaumont Water & Light Company. It has an authorized capital stock of $10,000, and the incorporators are E. B. Baldwin, E. V. Hayden and F. E. Potts.

LUBBOCK, TEX.—Articles of incorporation have been filed by the Lubbock Light, Ice & Power Company. It has an authorized capital stock of $25,000, and the following officers have been elected: W. D. Benson, president; N. D. Porter, vice-president; Charles A. Rush, secretary; B. O. McWhorter, treasurer.

Personal.

MR. D. W. LOWE, of Alliance, Ohio, will on Aug. 1 assume the duties of manager of the Michigan Power Company, Lansing, Mich.

MR. P. S. DODD has resigned as manager of *The Electrical Review and Western Electrician* and will shortly become connected with the incandescent lamp industry.

MR. DUDLEY T. COOK has resigned as manager of the Ottawa, Kan., telephone exchange to become contract agent of the Lincoln (Neb.) Telephone & Telegraph Company.

MR. JAMES BLAINE WALKER, assistant secretary of the New York Public Service Commission for the First District, delivered an address in Baltimore last week on "Public Utilities Commissions."

MR. B. J. JONES, formerly general manager of the Union Gas & Electric Company, of Cincinnati, Ohio, has been appointed general manager of the Ohio Electric Railway Company, Cincinnati, Ohio.

MR. J. H. McMANUS, for many years connected with the Westchester Lighting Company, in the Port Chester District, has joined the electrical department of the H. W. Johns-Manville Company, New York City.

MR. F. M. DAY, formerly connected with the Ohio Inspection Bureau and more lately with the Rocky Mountain Fire Underwriters' Association, has accepted a position as chief electrician for the American Lumber Company, Albuquerque, N. M.

MR. JAY F. HOOVER, who has been manager of the Cleveland office of the Nernst Lamp Company for the past five years, has been appointed special agent of the company, with headquarters in Pittsburgh. The Cleveland office is now in charge of Mr. J. B. Mitchell.

MR. CHAS. M. HALL, of the Aluminum Company of America, who was taken seriously ill in Southampton, Eng., has returned to this country and gone to Lake Placid, in the Adirondacks, to build up. Dr. W. H. Hodge, of Niagara Falls, went to England to attend on Mr. Hall.

MR. ALFRED G. HEINEMANN has resigned from the staff of George Heinemann & Company, Philadelphia, to become general manager of the Excelsior Electric Light, Power & Gas Company, Sellersville, Pa. The central plant at the latter place supplies Telford, West Telford, Louderton, Reliance, Hatfield, Silverdale and Sellersville.

MR. A. F. HEMINGWAY, formerly connected with the Wellman-Seaver-Morgan Company, of Cleveland, and the General Electric Company, is now looking after the interests of the Terry Steam Turbine Company, of Hartford, Conn., in Chicago, associated with Mr. Charles E. Billin, general agent for that company in Chicago.

PROF. L. P. DICKINSON, of the electrical engineering department of Lafayette College, Easton, Pa., has been appointed professor of electrical engineering at Rhode Island State College, Kingston, R. I., to succeed Prof. Gilbert Tolman, who recently resigned to accept a chair at Colby College, Maine. Prof. Dickinson was graduated from the Massachusetts Institute of Technology in 1896.

MR. W. H. ZIMMERMAN, present manager of the Michigan Power Company, will after Aug. 1 take personal charge of all construction work of the company, both in Lansing and for 18 miles of transmission lines to be constructed between that city and Charlotte. Mr. Zimmerman is also interested in the Construction Electric Company, which will erect local distributing services at Charlotte, Pottersville, Bellevue and Olivet.

MR. W. H. WISSING, recently connected with the Union Electric Light & Power Company, of St. Louis, is now general manager of the Tungstolier Company, of Cleveland, Ohio. Mr. Wissing devotes considerable attention to the development of central-station campaigns for new business, taking the broad view that whatever helps the electric light companies helps his business. His views in relation to methods of selling electrical devices for domestic purposes were set forth in an article on that subject written while he was in the central-station service and published in the issue of July 1.

MR. A. G. CHRISTIE, formerly in the steam-turbine departments of the Westinghouse and Allis-Chalmers companies, has been appointed assistant professor of steam engineering at the University of Wisconsin, and will have charge of the steam and gas engineering laboratories. Prof. Christie is a graduate in mechanical engineering from the University of Toronto, and served a year as instructor at Cornell. He was two and one-half years with the Westinghouse Machine Company, and the same period with the Allis-Chalmers Company, and for one year was chief engineer of the Western Canada Cement & Coal Company.

Obituary.

MR. R. PITCAIRN.—The death occurred at Pittsburgh on July 25 of Mr. Robert Pitcairn at the age of 73, the cause being general breakdown. He had been connected with the Pennsylvania Railroad for 55 years and was not only prominent as a railroad manager, but a leader in many other fields of enterprise. If the facts become known he will probably be found to have been one of the very rich men of the country, as his opportunities for accumulating wealth seemed boundless. Robert Pitcairn was born in Johnstone, near Paisley, Scotland, on May 6, 1836. He came to this country in 1846. Two years later, through the efforts of Andrew Carnegie, who then held a similar position, he became a messenger boy in the Pittsburgh office of the Atlantic & Ohio Telegraph Company. He was rapidly promoted. In 1853 he entered the service of the Pennsylvania Railroad Company as operator and assistant ticket agent at Duncanville, Pa. Mr. Pitcairn rose to be superintendent of the Middle Division, superintendent of transportation, and in 1865 superintendent of the Pittsburgh Division. His responsibilities were considerably increased 10 years later by his appointment as general agent of the Pennsylvania Railroad. Mr. Pitcairn was made assistant to President A. J. Cassatt in 1902, having his offices in Pittsburgh. Mr. Pitcairn was identified with most of the important public and financial interests of Pittsburgh. He was vice-president of the Westinghouse Air Brake Company, the American Surety Company of New York, and the Philadelphia National Gas Company. He was also a director in many other financial institutions. Mr. Pitcairn was Past Grand Commander of the Order of Knights Templar, a member of the Pennsylvania Society and one of the directors of the Carnegie Public Library in Pittsburgh. He married Elizabeth E. Rigg, of Altoona. His surviving children are: Mrs. Omar S. Decker, Mrs. Charles L. Taylor, Miss Susan B. Pitcairn and Robert Pitcairn, Jr. He was a member of the Old-Time Telegraphers' Association and was proud of his early connection with the telegraphic art. When the association visited Pittsburgh some years ago he was chief among its hospitable entertainers.

Trade Publications.

CENTRAL ELECTRIC BULLETINS.—The Central Electric Company, Chicago, Ill., is distributing two new bulletins, one descriptive of Siemens arc-light carbons and the other of Perkins and Bryant socket material. Both bulletins contain a complete list of the latest prices.

MINERAL GREASE.—The Keystone Lubricating Company, in a leaflet just published under the title of "High-Grade Petroleum Grease for Electric Railway Lubrication," sets forth the merits of mineral grease in general, and in particular with respect to its use in electric traction.

ELECTRICAL NECESSITIES.—Bulletin No. 18 of the Harvard Electric Company, Chicago and New York, has the title "Electrical Necessities," and describes and illustrates in detail the lengthy line of Harvard specialties, including channel steel brackets, self-soldering wire joints, section switch boxes, outlet, junction and ceiling boxes, fuse boxes, fuses, etc.

BAROMETRIC CONDENSER.—In a bulletin (No. 1519) just issued the Allis-Chalmers Company describes the Tomlinson barometric condenser, with especail reference to Type AN. No air-pump is required with this condenser, with which 28 in. of vacuum can be maintained. The condenser is claimed to be the most simple and efficient apparatus of this type thus far developed.

DRY BATTERIES.—The Central Electric Company, Chicago, Ill., is distributing several new flyers descriptive of dry batteries. The batteries described are intended for open circuit service, and are claimed to give maximum service with minimum cost, owing to the use of the highest grade of material, best methods of treatment and modern machinery in their manufacture.

PATROL FLASH LIGHT.—The Dean Electric Company, Elyria, Ohio, describes in a pamphlet just issued, with reference in part to illustrations in colors, its patrol flash-light police and fire system. Among the features of the police system is the lighting from headquarters of an incandescent lamp within the patrol box, the light from which passes through powerful red lenses in the front and two sides; the light is also automatically turned on when making a fire alarm.

SHERARDUCT CONDUIT.—An excellent example of a trade publication at its best is furnished by a pamphlet just issued by the National Metal Molding Company, Pittsburgh, describing "Sherarduct" conduit and setting forth its merits. The literary character of the text is such as to create respect for its matter, and the typography is good in design and in execution. The conduit described, which is of mild steel that bends easily, is treated by the Sherard process, by means of which, it is claimed, corrosion is entirely prevented even under the most adverse circumstances.

MOTOR STARTERS, RHEOSTATS, ETC.—The Ward Leonard Electric Company, of Bronxville, N. Y., has issued a new catalog, of which 20 sections are devoted to hand and automatic motor starters, 14 sections to hand-operated armature controllers, 12 sections to generator and motor-field rheostats for several requirements of service, including concentric shaft field rheostats, rheostats for plating generators, with and without potentiometer connections, etc., and a number of sections to enameled resistance units, showing methods of mounting them in lamp sockets, fuse clips, etc. New designs of theater dimmers are shown, both hand and motor-driven. Other sections are devoted to the manufacture of incandescent lamp, projector and searchlight rheostats, photometer rheostats, desk-fan and ceiling-fan controllers, etc.

Business Notes.

THE LORD ELECTRIC COMPANY reports that it has just received a very substantial order for Earll catchers and retrievers as the result of service tests of eight months.

THE BAKER ELECTRIC COMPANY, Chicago, has leased for a term of 10 years a building to be erected for it on a lot 50x160 ft. on Michigan Avenue, near Twenty-third Street, Chicago.

M. L. NEWMAN & CO., consulting and industrial engineers, have established their office at 26 Broad Street, New York, and not at 25 Broad Street, as erroneously stated in these columns last week.

DOSSERT & COMPANY, New York, have concluded an arrangement with the Western Engineering Specialties Company, 1732 Glenarm

Street, Denver, Colo., to act as their agent in the Rocky Mountain Territory. A large stock of connectors will be carried in Denver.

THE D & W FUSE COMPANY, of Providence, announces that it is now manufacturing "Deltabeston" coils wound with Deltabeston magnet wire insulated with pure asbestos material throughout. The new process of treating the coils renders the coils both heat-proof and moisture-proof.

REFRIGERATING PLANTS.—In the past three months the York Manufacturing Company, York, Pa., has supplied 39 ice-making and refrigerating plants ranging in capacity from two to 90 tons of ice daily. Among the purchasers are the Sterling Consolidated Electric Company, Sterling, Col., and the University of Nebraska, each of which purchased a 10-ton plant.

THE VOLKMER ELECTRICAL COMPANY, 585 Hudson Street, New York, announces that its Type No. 3 "Daylight" arc lamp is now ready for the market. This lamp has undergone many improvements since it was first placed on the market a few months ago. The company has made several large installations recently of the new lamps, which are stated to be giving great satisfaction.

THE MINNEAPOLIS STEEL & MACHINERY COMPANY has received from the Huron Light & Power Company, Huron, S. D., a contract for furnishing the new engines for the electric light plant. There will be installed one 100-hp and one 150-hp Muenzel producer-gas engine, together with two 150-hp Muenzel gas producers to replace the present steam equipment. Both of the engines will be belted to altrnating-current generators.

NEW BUILDING FOR FOSTORIA INCANDESCENT LAMP COMPANY.—Plans are being prepared and ground will shortly be broken for the erection of a two-story brick office building for the Fostoria Incandescent Lamp Company, of Fostoria, Ohio. The site is directly across the street from present factory and office. The building will cover an area of 4000 sq. ft. It is expected the structure will be ready for occupancy in November.

TRIUMPH ELECTRIC NEW FACTORY.—The new factory of the Triumph Electric Company at Oakley, near Cincinnati, has been practically completed and the new machinery will be moved from the old plant at Hathaway and Baymiller Streets, Cincinnati, by Aug. 1. The new building contains over 125,000 sq. ft. of floor space and is 140 ft. wide. The heavy machinery will be placed on the ground floor, the medium weight on a first balcony and the light machinery on a second balcony. As there will be a 60-ft. center opening, all heavy material may be handled with cranes or other lifts, instead of trucks.

WATER POWER PLANT.—The Hartford Faience Company, of Hartford, Conn., Mr. F. L. Bishop treasurer, advises us that it knows of a first-class water power at Winsted, Conn., that can be bought at a very reasonable figure; and in regard to which Mr. Bishop will be glad to answer inquiries. The capacity is said to be about 100 hp, never failing. The plant carries with it the entire control of the water power and of the water gate. There is a large brick building 145 ft. x 41 ft. and other buildings on the property, and an electric lighting plant for factory use. A mortgage of $15,000 can remain on this plant, which may interest some of our manufacturing friends.

THE TECHNICAL INDEX, a comprehensive record of current technical literature published in Belgium, announces that hereafter it will be represented in the United States by the Geo. H. Gibson Company, Tribune Building, New York City. The journal appears monthly and gives a systematic descriptive record of all original articles appearing in over 200 engineering and technical journals and reviews, and also indexes the proceedings of technical societies and technical books issued in all countries. Two editions are printed, one upon both sides of the paper and one upon one side only for card index purposes, and for further convenience all items are arranged according to the Dewey decimal system. Clippings or copies or articles, also books, are supplied by the publishers, the price being indicated in each case.

WESTINGHOUSE BALTIMORE SHOWROOM.—The Westinghouse Electric & Manufacturing Company has recently opened a showroom at 121 East Baltimore Street, Baltimore, where it occupies a two-story building devoted to offices and display rooms. Heretofore the company has only had offices and storerooms in the city, and by leasing this store on one of Baltimore's principal streets it places its goods more prominently before electrical contractors, jobbers and visiting central-station men. Mr. M. H. Jones is in charge of this department, known as "General Sales." To fill the position of chief correspondence clerk, formerly held by Mr. Jones, Mr. E. W. Brown, of the erecting department, Pittsburgh, will be appointed. The entire first floor of the building is devoted to an exhibition of electric heating apparatus, arc lamps, portable testing instruments, fans, electric irons and other small apparatus. A large and varied stock of supplies will be carried in the basement and sub-basement, from which jobbers and dealers will be able to draw at all times, thereby obviating the delays incident to a shipment direct from the factories. The second floor is divided into offices for the various departments, consisting of clerical, consultation, Government, railways and lighting, industrial and power, detail and supplies, erection and general manager and correspondence.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JULY 13, 1909.

[Conducted by W. F. Bissing, Patent Law, 2 Rector Street, N. Y. City.]

The following list contains patents that should have appeared in last week's issue, but were not received in time from the Patent Office, owing to the failure of the contractors to supply copies. The patents which should have appeared this week under date of July 22 will be delayed until next week.

927,469. SENDER FOR SELECTIVE SYSTEMS; F. G. Agrell, Stockholm, Sweden. App. filed Aug. 3, 1907. A dial type of switch combined with an arc-shaped series of switch contacts, thus forming two switches at the subscriber's station, one set to correspond to the number desired and another operating in conjunction with a switch hook to send out the impulses.

927,470. TELEPHONE DIVIDED MULTIPLE SWITCHBOARD SYSTEM; W. Aitken, Muswell Hill, England. App. filed Aug. 27, 1900. A central source of current, a plurality of signals located on different divisions of the switchboard, switches at the substation, one for each signal, for selectively operating them, and means for maintaining any of said signals in operative condition after the release of the switches.

927,482. LIGHTING SYSTEM; W. L. Bliss, New York, N. Y. App. filed June 8, 1904. For car and train lighting in which a generator supplies the current and charges the storage battery, having a rheostatic regulator to regulate the generator controlled by a winding supplied with current proportional to the current the generator sends through the storage battery.

927,486. ELECTRIC TIME SWITCH; O. A. Brunn, Copenhagen, Denmark. App. filed March 26, 1907. Closes a circuit when a push-button is pressed for a definite time by means of an air bag or bellows which determines the period of closure, instead of using clockwork.

927,513. LIFTING MAGNET; A. C. Eastwood, Cleveland, Ohio. App. filed June 11, 1906. The lifting coil is embedded in an angular casing with heat-dissipating walls.

927,519. OZONE GENERATOR; T. Friedlander, Chicago, Ill. App. filed July 24, 1908. A pair of concentrically arranged tubes of insulating material, a pair of electrodes consisting of coils of wire wound on the respective tubes, the air space between the electrodes providing the air to be ozonized.

927,541. ELECTROMAGNETIC GOVERNOR FOR INTERNAL COMBUSTION ENGINES; E. Hubbard, Chicago, Ill. App. filed Aug. 24, 1908. A solenoid with a movable core connected to the governor and an annular weight fulcrumed at one side of the solenoid which is disengaged to act on the governor when the solenoid is de-energized, shutting off the supply of fuel.

927,583. ANNUNCIATOR FOR CHECKERS OR SIMILAR GAMES; A. Nelson, St. Paul, Minn. App. filed Sept. 16, 1907. Reproduces upon an illuminated board the movements and positions of the men upon a checker-board.

927,602. SIGNALING SYSTEM; H. O. Rugh, Sandwich, Ill. App. filed June 26, 1908. An improved selector system for railroad telegraph circuits, including polarized relays and a selector mechanism for each relay.

927,611. WIRELESS TELEGRAPHY; J. H. Cuntz, Hobozen, N. J. App. filed March 16, 1903. Separates the waves into groups of low group frequency and places in the receiving circuit a tuning fork tuned to the group frequency.

927,643. TRANSMITTER MOUTHPIECE; W. W. Dean, Elyria, Ohio. App. filed Oct. 8, 1908. A sheet steel metal mouthpiece with perforations in the end wall and an enamel coating.

927,651. SELECTIVE TELEPHONE SYSTEM; H. G. Guyle, Sargent, Neb. App. filed Jan. 25, 1905. Provides a plurality of rotatable disks, one at each station; a plurality of time wheels, one at each station, the disks and wheels being locked or released as desired with means for simultaneously releasing all of the time wheels excepting those at the calling and receiving stations.

927,663. HARMONIC SIGNALING SYSTEM AND MAGNETIC HAND GENERATOR THEREFOR; R. H. Manson, Elyria, Ohio App. filed Feb. 1, 1907. For telephone system in which the annunciator is actuated from a substation without actuating any of the ringers at the subscriber's station by means of a commutator arrangement regulating the current from a hand generator.

927,664. OPERATOR'S KEY; R. H. Manson, Elyria, Ohio. App. filed Aug. 23, 1907. Ringing and listening key having dummy springs so adjusted that they must move a considerable distance before they engage the contact spring to cause disconnection thereof from the normal contact spring and connection with the alternate contact spring, thus permitting the overthrow of the key.

927,675. MEANS FOR UTILIZING ELECTRICAL ENERGY; T. F. Perkins, Atlanta, Tex. App. filed March 1, 1907. The extra current produced by the discharge of the field magnets of the motor is directed into another circuit containing lamps.

927,701. INSULATOR SUPPORT; F. Woodmansee, Chicago, Ill. App. filed Feb. 8, 1904. The base portion is rectangular and carries an upright post, the base being curved to form a water shed.

927,708. TROLLEY POLE GUIDE; J. P. Brennan, Centralia, Pa. App. filed Dec. 26, 1908. The wheel support is provided with pivot arms that rise above the trolley wire and may be operated by a rope.

927,714. ELECTRIC SWITCH INSTRUMENT; C. W. Coleman, Westfield, N. J. App. filed Dec. 22, 1905. A switch instrument for tracks provided with a rocking frame and links connecting the rocking frame with the respective switches.

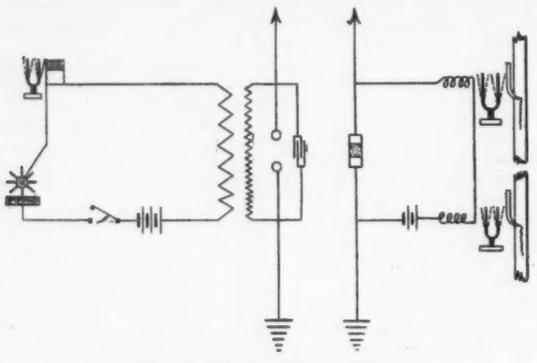
927,733. METHOD OF OPERATING ALTERNATING-CURRENT MERCURY WATTMETERS; R. C. Lanphier, Springfield, Ill. App. filed Feb. 9, 1906. The method of operating consists in bringing the current in the pressure circuit into phase with the impressed electromotive force.

927,739. RELAY; R. H. Manson, Elyria, Ohio. App. filed Aug. 23, 1907. Relay for telephone work of small size carrying an armature rigidly mounted on a core and a contact supported on the core by suitable fastenings.

927,755. ELECTRICALLY HEATED WATER FAUCET; F. A. Robinson, Pittsfield, Mass. App. filed May 29, 1907. Provides the faucet with an electric heater and an electric switch adapted to close the circuit when hot water is desired and to open the circuit when cold water is desired.

927,758. PROCESS OF TREATING SILICATES OF ALUMINUM FOR THE PURPOSE OF OBTAINING VALUABLE PRODUCTS; A. Sinding-Larsen, Christiania, Norway. App. filed Nov. 7, 1907. Process of treating silicates of aluminum by feeding the material to one end of a long electric furnace and a mixture of iron and a reducing agent to the other end and passing an electric current there between.

927,812. BATTERY GRID; J. K. Pumpelly, Indianapolis, Ind. App. filed June 8, 1908. A two-part grid comprising two perforated plates



927,641—Wireless Telegraphy.

having inwardly projecting tapered ribs extending beyond the marginal ribs.

927,817. HYGIENIC ATTACHMENT FOR TELEPHONE TRANSMITTERS; Eliza C. Smith, Washington, D. C. App. filed Sept. 24, 1908. Detachable cup or cone for covering the mouthpiece.

927,907. ELECTRIC APPARATUS FOR DRIVING CLOCK OF SIMILAR MECHANISMS; H. E. Warren, Ashland, Mass. App. filed Oct. 22, 1908. Makes use of a pair of contacts in circuit with the impulse device which are urged toward each other and when released strike together and serve as a make-and-break to continue the movement of the pendulum.

927,917. SWITCH MECHANISM FOR TROLLEY WIRES; F. M. Zimmerman, Aurora, Ill. App. filed Feb. 1, 1908. An arched bridge piece having conductor wire channels and replacable switch mechanism under the wires and bridge piece.

927,935. METHOD OF MANUFACTURING FILAMENTS FOR ELECTRIC LAMPS; W. Von Bolton, Charlottenburg, Germany. App. filed Oct. 22, 1907. Mixes comminuted refractory metals and comminuted ductile metal together, electrically heats the mixture and draws the mass into filaments.

927,959. RESONATOR; P. E. Finlay, New Orleans, La. App. filed Nov. 24, 1908. For increasing the sound of telephone bells by placing a reflecting casing back of the bell covered by a hood.

927,970. ELECTROLYZER; E. Hixon, Chicago, Ill. App. filed Feb. 25, 1909. Tank has a plurality of vertical transverse partitions, some of which have openings at the bottom and the others at the top. Designed for the manufacture of bleaching liquid.

928,004. INTERDEPENDENT SIGNAL AND SWITCH APPARATUS FOR RAILWAYS; F. Prochaska, Berlin, Germany. App. filed April 10, 1906. A single series of supervising devices dependent upon the condition of the switches; selective devices for the routes and means operated by the selective devices for making only the supervising devices belonging to the selective route operative.

928,010. CROSSARM FITTING AND INSULATOR SUPPORT; S. B. Way, St. Louis, Mo. App. filed Jan. 11, 1909. Improved insulator support which clamps the crossarm on all four sides.

928,013. ACCELERATION CONTROLLING DEVICE; V. A. Wolcott, Schenectady, N. Y. App. filed May 16, 1908. For mining locomotives in which the vehicle carries a cable reel, a reel motor connected thereto, with means for automatically increasing the voltage applied to the reel motor during the acceleration thereof.

928,016. TROLLEY HARP MOUNTING; G. L. Adams, Altoona, Pa. App. filed Nov. 21, 1908. The pole has a head with an oblique socket carrying a stem with a port on which the wheel is mounted.

928,021. SIGNAL SYSTEM; E. F. Bliss, Schenectady, N. Y. App. filed May 6, 1909. Block signal system in which a source of alternating current is supplied to the track, and a track relay is thus supplied with current, the relay having a winding and a member adapted to be vibrated by the current in the winding, tuned to a natural period of vibration corresponding to the normal frequency and a signal controlled by the member.

928,028. CONTROLLER FOR ELECTRIC MOTORS; V. E. Chamberlain, Indianapolis, Ind. App. filed April 27, 1907. For controlling automobiles in which a motor has a number of field windings and a controller has contacts arranged to close the circuits with the fields in series, to shunt one of the fields, to throw the fields in parallel, all without breaking the connection.

928,037. DYNAMO-ELECTRIC MACHINE; H. W. Frost, Schenectady, N. Y. App. filed July 25, 1904. High-speed dynamo driven by steam turbine in which the field magnet consists of sets of units, each having a plurality of tongue-receiving notches into which the polar projections enter.

928,049. LIGHTNING ARRESTER; E. M. Hewlett and E. B. Merriam, Schenectady, N. Y. App. filed May 18, 1907. For high potential discharges in which a plurality of conductors are spaced apart to form gaps by mounting them on insulating rings within a tube.

928,068. ELECTRIC SWITCH-CONTROLLING SYSTEM; F. G. Proutt, Memphis, Tenn. App. filed Sept. 13, 1904. For cutting out arc lights in street lighting by means of a shunt circuit connected with the line, a switch between the shunt circuit and the lamp, a solenoid in the shunt circuit controlling the switch and an electromagnet holding the switch in position.

928,074. COATED ARTICLE AND PROCESS OF MAKING SAME; H. Shoemaker and F. W. Midgley, Jersey City, N. J. App. filed Jan. 8, 1909. For making condensers by roughening the surface of the glass, coating it and then grinding off the excess of coating material.

928,082. WATER GAGE; J. Torok, Renovo, Pa. App. filed Feb. 13, 1909. A water gage provided with a casing connected to the boiler, the casing containing electrodes through which the circuit is established by a movable float.

928,084. INSULATING STUD; L. E. Underwood, Lynn, Mass. App. filed May 5, 1908. An insulating stud for brush holders comprising a supporting rod, a metal tube thereon and an insulating tube between the rod and the metal tube and extending beyond the rod at one end and beyond the tube at the other end.

928,089. PYRO-ELECTRIC GENERATOR; G. J. Vokel, Philadelphia, Pa. App. filed Jan. 21, 1909. A plurality of series of thermocouples are supported on a frame and bodies of refractory material extend between the adjacent series of couples to form an enclosure, and the heating device, such as a burner, is mounted within the enclosure.

928,096. MICROPHONE; G. Angelini, Rome, Italy. App. filed March 28, 1907. The disk carries a ring of felt next to which is arranged a large flexible disk covered with wadding, the carbon granules being between the disks.

928,104. RELAY; E. R. Brodton, Mobile, Ala. App. filed Aug. 3, 1908. Operates only under a predetermined current so as to selectively operate bells or typewriter keys over a line. The relay controls a plurality of armatures, each controlling a line circuit.

928,119. TROLLEY WHEEL; T. A. Gannoe, Warren, Pa. App. filed Feb. 18, 1908. The trolley wheel is mounted on a series of arc-shaped springs forming the spokes of the wheel.

928,136. CONSTRUCTION OF ELECTROMAGNETS; H. Lacy, Carshalton, England. App. filed Aug. 31, 1906. The magnet contains a core and carries groups of layers of wire, the diameter of the wire diminishing in each group and the number of layers increasing.

928,152. ELECTRIC SWITCH HANDLE; C. D. Platt, Bridgeport, Conn. App. filed Feb. 5, 1909. A turn button having a recess in its under side, a shank thereon and inverted cup sliding on the shank and forced upwardly by a spring.

928,157. TROLLEY WIRE SWITCH; H. O. Shissler, Des Moines, Ia. App. filed April 18, 1907. The movable switch wire is automatically actuated in unison with the switch point in the track below by connections from the switch stand.

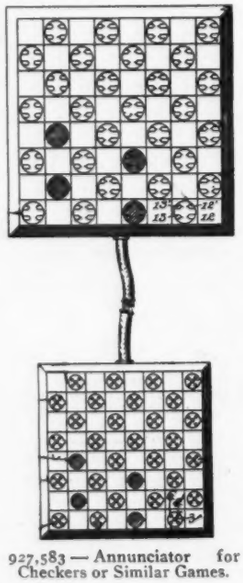
928,161. ARC LAMP; G. E. Stevens, Lynn, Mass. App. filed Aug. 14, 1903. Regulator for arc lamps in which the follower block is guided by posts and is made of insulating, non-combustible material, the block carrying the electrode.

928,171. TELEPHONE SYSTEM; M. Baumer, Nuremberg, Germany. App. filed Nov. 24, 1908. For automatic branch exchanges in which tip relays, each having two coils, are employed to start the automatic switch. Details.

928,189. ARC LAMP; R. Fleming and C. A. B. Halvorson, Jr., Lynn, Mass. App. filed Jan. 16, 1906. Improvement in the electrode feeding mechanism, the support for the electrode being movable parallel to its axis and about another axis parallel to that of the electrode.

928,204. INDUCTION COIL FOR IGNITION SYSTEMS; B. L. Lawton, Meriden, Conn. App. filed Jan. 25, 1909. To avoid the untimely ignition of compressed gas in a cylinder due to magnetic or static induction between the primaries and secondaries of the coils by proving an open circuit shield between adjacent coils to prevent interference.

928,214. MEANS FOR UTILIZING ELECTRICAL ENERGY; T. F. Perkins, Atlanta, Tex. App. filed Aug. 15, 1908. Utilizes the extra



927,583 — Annunciator for Checkers or Similar Games.

928,224 — Electrical Condenser and Process of Making Same.

current which ordinarily produces sparks on the commutator by sending the current through a transformer which lights lamps.

928,219. SYSTEM OF DISTRIBUTION; P. Rose, Berlin, Germany. App. filed Jan. 28, 1909. For automatically distributing a load on two alternating or direct separately excited generators operating in parallel, by making the regulator of each machine sensitive to changes of current in the armature leads of the other machine.

928,224. ELECTRICAL CONDENSER AND PROCESS OF MAKING SAME; H. Shoemaker and F. W. Midgley, Jersey City, N. J. App. filed Jan. 8, 1909. The condenser comprises glass having a roughened surface with a preliminary coating of conducting material and another coating electrically deposited upon the preliminary coating.